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OBITUARY—JOSEPH RUSSELL THOMAS.

A long, honorable, useful and benevolent temporal life was brought to a close when death, on the evening of Saturday, November 28th last, came to Joseph R. Thomas, whose passing over was the termination of an illness the successive stages of which were borne with rare fortitude and patience. As he had lived, so did he respond to the dread summons; without complaining, and resignedly, in the full knowledge that his span of life had been beyond that of most men, he passed away, with those he held dearest in loving, sorrowful attendance.

Conformably to our announcement of a week ago we herewith present a record of his life, which is as complete as the short time at our disposal, considering the period to be covered, permits.

Joseph Russell Thomas was born March 11th, 1820, in Burlington, N. J., during the temporary sojourn there of the Thomas family. In reality, the latter should be held as Philadelphians, for the subject of this sketch was the only one of the family who could not claim Philadelphia as a birthplace. His father (Mr. W. R. Thomas) came direct to Philadelphia from Wales, and his mother's people had for many years been residents of that city. While still an infant his parents returned to Philadelphia, and there he grew up, acquiring his education in the public schools, and also under the tuition of his father, who was a man noted in those days for his theoretical and practical knowledge in certain lines—especially in respect of the making of the pressed brick that subsequently caused Philadelphia early to become famous in the building trade of America. His primary education having been completed, he was apprenticed to a prominent carpenter and builder of Philadelphia, and learned the trade of carpenter from a true, practical standpoint. Although possessed of real mechanical genius, and with a decided leaning towards following a higher plane in that respect than the avenue afforded by the pursuit of carpentry, we next find him engaged on his own account in the grocery business, an experiment, however, that was not of long duration. Some time prior to this (as near as we can approximate the year was 1838) the business of gas works construction in this country was assuming sufficient importance to attract the attention of American workers in iron; for prior to that year almost all of the construction on gas works account in America had been carried on under the supervision of English engineers, who naturally preferred to import the materials used in their buildings, rather than to make their appeals for such supplies to American producers. It is true that gas works contracting firms existed in America at that time, but their efforts and practices were feeble in comparison with those which resulted from the formation of the concern at Camden, N. J., which concern was originally arranged by the Messrs. Starr, whose previous efforts had largely been confined to the building of boilers and other works incident thereto. With the formation of what may be called the Camden Iron Works may be dated the decline of the influence of direct English gas works construction in America, and the position of the pioneer layer-out of American gas works buildings may in all fairness be allotted to Mr. Samuel A. Thomas, an elder brother of the subject of this memoir, who was at the period noted in charge of the gas division of the Messrs. Starr's iron works.

Mr. John W. Starr, who was one of the members of the Camden Iron Works Company, took a special contract to perform certain work on vessels that were being constructed in Hoboken, N. J., under the auspices of the Messrs. Stevens, and Mr. Joseph R. Thomas, dissatisfied with the mercantile trade, accepted an offer (about 1845) to assist in the building of the ships under the Starr contract. When the contract made by Mr. John W. Starr with the Messrs. Stevens was completed, Mr. Thomas re-engaged himself with the Stevens, and worked for them on the construction of that queer pile known to history as the Stevens Battery. Meanwhile the gas works division of the Messrs. Starr's works was assuming vast importance, and in 1848 Mr. Thomas removed to Camden, N. J., and entered their employ. During his spare times of day and night he devoted himself to the study of mechanical engineering, during his busy times of day and night measuring theory with practice; and his aptitude for study and his faculty for adapting to actual practice the hints that theory afforded, were such as to attract

the attention of his employers. The result was that he was soon named to direct the actual construction of gas contract work that had been awarded the firm.

About 1850 the proprietors of the New York Gas Light Company had decided to remove their manufacturing plant, from its original site at Center, Hester and Canal streets, to a location (21st and 22d streets, and what then, to every intent and purpose, was the East River), that it was estimated would be the final boundary of New York city, east side. The contract for this construction, as to the buildings and house iron work, was awarded to the Messrs. Starr, and the latter named Mr. Joseph R. Thomas to superintend the details of that uprearing. The work in hand was a vast one in those days of American gas works practice, but it was completed within the time of the contract and to the satisfaction of the New York Company's President, Mr. William M. Fox. If we mistake not, the plant was finally completed January, 1851. Between times (in the winter of 1851) Mr. Thomas and his men were engaged in the construction of the works of the "Gas Light Company, of the City of New Brunswick," N. J., also under contract by the Messrs. Starr. Following the completion of these works, he undertook, and successfully carried out, the erection of the plant of the "City Gas Light Company," of Norfolk, Va.; another of the Starr contracts. At this time internal dissensions were manifested in the Starr concern, and, rather than take sides with either faction, Mr. Thomas resigned from their service. His fame as a constructor, however, was well established, and in a short time he accepted a contract to enlarge the works at Detroit, Mich., which, although constructed in 1849, had been planned on so small a scale, so rapid had been the growth of the place, that extensions (corrections of errors in original laying out might better express the situation) were necessary in 1851. If we mistake not, the proprietor then of the Detroit plant was a Mr. Davis, who was so well satisfied with the betterments that Mr. Thomas had made on the works, that he added a substantial bonus to the contractor's terms; a payment not often experienced by current-time builders. Mr. Thomas returned East in 1852 and was retained for a year (1853) by a Philadelphian, who proposed engaging in gas works construction, but who eventually abandoned the idea—our recollection is that a Mr. Mead was his employer. At the termination of that contract Mr. Thomas' services were in demand amongst those concerned in the gas industry; but of all the offers that came to him he listened favorably to the proposition advanced by Mr. John W. Starr, for between Mr. Thomas and Mr. John W. Starr existed a bond of association and of belief in each other's integrity and faithfulness seldom noted as of employed and employer.

Mr. J. W. Starr at that time was heavily interested in the fortunes of the Williamsburgh Gas Light Company. Incorporated in 1850, the Company was formed to supply gas to a district immediately adjoining the eastern boundery line of Brooklyn, N. Y. The territory then was sparsely settled, and the lowlands that separated it from Brooklyn, to the south and west, seemingly unfillable, as were the marshes to the north and east that divided it from Greenpoint. The Williamsburgh plant itself was but a ramshackle affair, and ill-located for even the duty to be exacted from it—so the situation was not one of promise. Mr. Thomas, however, accepted the trust and assumed the position of Engineer and Superintendent to the Company in January, 1854. In the same year the districts of Williamsburgh, Brooklyn and Bushwick (the latter was contiguous to the two first-named, on the east) were united as Brooklyn. The marshes were filled, the Williamsburgh district grew with amazing rapidity, and the clever and capable direction of the Williamsburgh Company's affairs by Mr. Thomas was such that, in 1861, the Company, instead of being bankrupt, as it virtually was in 1854, owned a works that was second to none in the country for the completeness of its equipment and its ability to produce and supply a gas that answered fully the demands of its customers. In 1855 Mr. Thomas was elected to the Board of Directors of the Williamsburgh Gas Company, and served thereon until 1883, when differences between the Company's proprietors and himself, as to the policy to be pursued in its future management, caused him to *voluntarily* retire from all active participation in its affairs. His record with the Company was that of unbroken success; as faithful to its interests as the parent is to the child, he found it a weakling, he left it a giant of commercial strength. During his engineering direction of the Williamsburgh Company his services as consulting engineer to other gas enterprises were many. In fact, our space is altogether too short to enumerate them. Notable, however, was his connection with either the direct construction or reconstruction of the plants at Flushing, College Point, Jamaica, Fishkill, Tarrytown, Sing Sing and Poughkeepsie, in this State. The Long Branch (N. J.) Gas Light Company's works were completed by him, about 1870, after the contractors had to all intent and purpose failed in their construction. He accepted the Presidency of the Company, and under its fostering care it prospered. This interest he held until, we think, 1885, when it was taken over by a syndicate of New York capitalists, headed by Mr. H. E. Gawtry. But to attempt to name all the places the gas works of which bear the impress of his master hand is beyond the compass of this history.

On retiring from the Williamsburgh Company he assumed the editorial control of the JOURNAL (June, 1883), and his course in this connection requires no word of explanation or comment now. Fearless in his probity, our readers know that his work was done as befits the work of a man whose sole aim is to regard the right, and that only.

To speak as briefly as possible of the honors bestowed upon him by his engineering associates, we submit the following record: An original member of the Society of Gas Lighting of New York, he was its President from the date of its formation, December, 1875; was elected to Honorary Membership in the New England Association of Gas Engineers, February, 1878; to Honorary Membership in the Western Gas Association, May, 1884; to Honorary Membership in the Ohio Association, March, 1886; and to Honorary Membership in the Guild of Gas Managers,———. He had also been an active member of the American Gas Light Association since October, 1883, and joined the American Society of Civil Engineers October, 5, 1881.

Nor was his connection with these bodies of the passive sort, for few of their meetings were missed by him when physical ability was the permitting factor. We need not here recount his worth as an engineer, or speak of the value or of the frequency of his advice to those who sought it. The one is of public record; the other is known to those who availed themselves of it. He was ever ready to counsel and advise; and his counsel and advice were sound and valuable.

Naturally he was prominent in the communities in which he lived in other directions than those that mapped his business career, and for well over a quarter of a century no other man was more concerned with the best life of the Eastern District of Brooklyn than was Joseph R. Thomas. It was largely through his subscription that Christ Episcopal Church, on Bedford avenue, Brooklyn, was built. For many years he served it as vestryman, and no one of its three pastors ever appealed to him in vain for that which would advance its cause. For years he had been a trustee and valued adviser of the Dime Savings Bank, of Williamsburgh, an active supporter of the Williamsburgh Public Dispensary, and of the Williamsburgh Public Library Association. He was also a liberal patron to and member of the Brooklyn Art Association. During the troublous times of the Rebellion he was a member of the guard for local defence, out of which sprang the 47th Regiment, N. G. S. N. Y. He had attained high honors in Masonry through his affiliation with Hyatt Lodge, No. 205, of which body he was Master for several terms. He was also prominent in De Witt Clinton Commandery, K.T., of which body he had been Commander.

Paying heed to the request of his widow, we omit any reference to his domestic life, save that we feel obliged to say that it was thoroughly in accord with his public career—honest, staunch and lovable. His widow, a daughter and a sister survive him.

The funeral services were celebrated in Christ Episcopal Church, Glen Ridge, N. J., where was situated his country home, on the afternoon of the 3d inst., the beautiful Episcopal ritual being read by the Rev. Edwin A. White, the Rector, assisted by the Rev. Dr. James H. Darlington, Rector of Christ Church, Brooklyn. The pall bearers were named by the Society of Gas Lighting. The services concluded, the remains were temporarily interred in the receiving vault of the Bloomfield (N. J.) Cemetery, a prelude to their final placing in Cypress Hills Cemetery, Brooklyn, N. Y.

DEATH OF MR. GIDEON WOOD.

"The announcement of the death of Gideon Wood, on Sunday, Dec. 6th, in the 79th year of his age, will recall to his fellow members of the American and New England Associations his striking personality of speech and figure, and his strict, commonplace honesty. As a Superintendent of the old school he continued his connection with the New Bedford (Mass.) Gas Light Company, as Clerk and Superintendent, for nearly 40 years, remaining all his life with this one Company, resigning in 1889, at the age of 71, since which time, on account of failing health, he had seldom been seen at any of the Association meetings. A sheaf of ripened wheat, placed on his casket at the request of the members of the New England Association of Gas Engineers, expresses perhaps as well as could be expressed the feelings of those who respected his sincerity of character."—T.

A New Stack of Benches at the Portland (Me.) Works.

By "RETORT."

While it may be a truism that "There is nothing new under the sun," the nature of the practice employed in constructing a new stack of benches is always interesting to the gas engineer; and that em ployed in building the new stack of benches at the works of the Portland Company is of a kind that makes a description of it interesting.

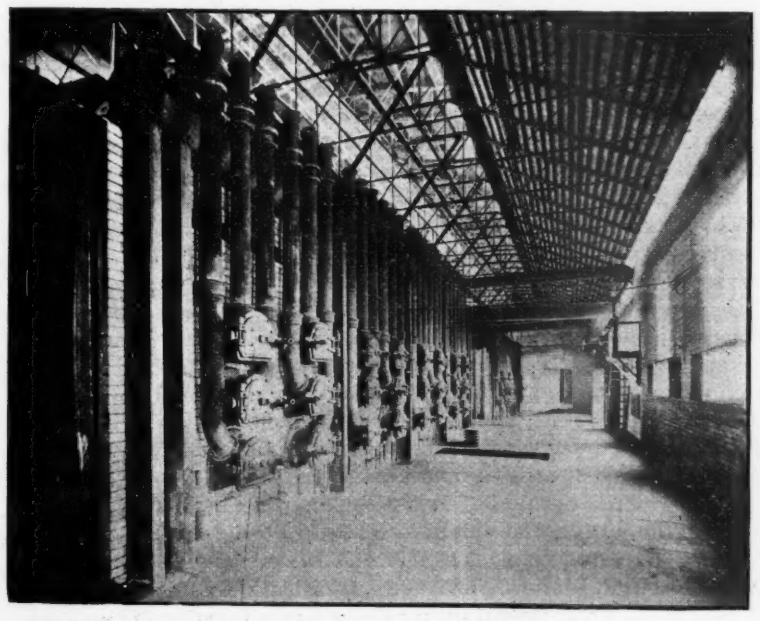
After sounding had demonstrated that rubble masonry was suitable for a foundation, it was put in, and the stack walls started at a point 4 feet below floor line. The end walls were made 31½ inches, and the division walls 22½ inches thick. The arches were 7 feet 10 inches, over which were "turned" arches, constructed of 9-inch arch blocks. Over these arches was left a 1-inch air space, and then another arch was "turned," 4½ inches thick, and above this arch five courses of brick were laid.

The stack is a double stack (benches back to back), the wall between the back of benches being 18 inches from face to face, in which were constructed 9 inch by 11 inch vertical flues. A continuous chimney 4 feet high runs the entire length of stack, on top of which, over each flue, was placed an angle cast iron tap, 18 inches high, to deflect the heat from the roof tie rods.

The entire stack was constructed wholly of firebrick, excepting one course of red brick on outside of chimney. A hollow cast iron arch bar was placed in front of arches. Ten-inch I-beams were used for buckstaves, connected with Norway iron tie-rods. Under the nut of each bolt end was placed a 3-inch thick rubber washer.

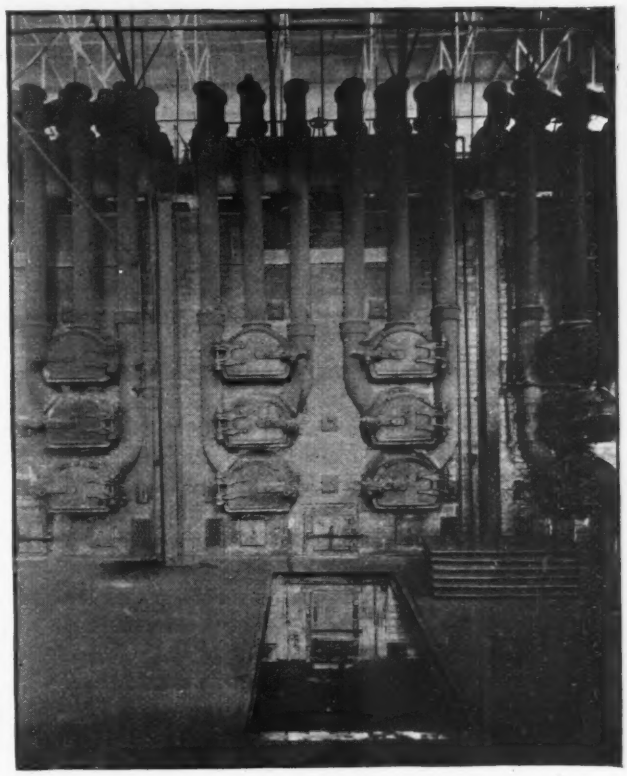
In front of each bench was constructed a pit, extending outward 8 feet 10 inches, of same width, and 4 inches deep, the bottom of which was paved with red brick on the level of the bottom of ashpan. Three rows of cast iron ribbed plates were placed over these pits, the two outside rows being supported on one end by the brick party walls between the pits, and the other end on 6-inch I-beams, both ends of center rows resting on the I-beams, and having two cup holes (in which were cast an iron rod) for the lifting hooks. The admission of air to the pits was made by leaving air ducts in front walls of benches, extending above and below the floor plates, and protected above by a cast iron grating.

The furnace construction was an adaptation of the established principles of the half-depth regenerative furnace—*i. e.*, secondary air flues running to back of furnace and there forward to front end, with air ports over the fire. The lower door frame has two doors in it, one for ashpan and the other for furnace. Steam was conducted to ashpan through perforated pipes, the perforations being opposite the primary air ducts. Furnace blocks of tapering form, which increased the width of furnace from 14 inches at the bottom to 20 inches at middle of furnace, and flue blocks in which the flues were moulded, were used.



General View of Stack.

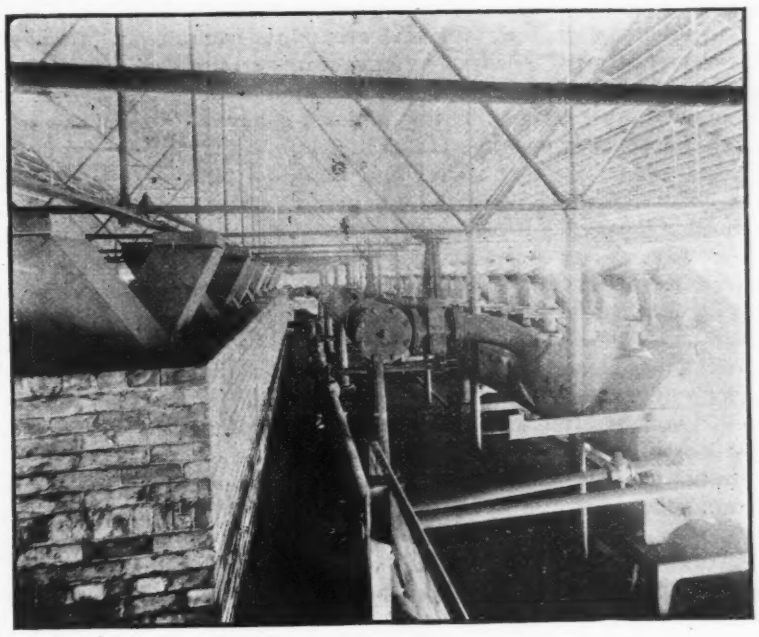
Brenner self-sealing lids were attached to each mouthpiece. The hydraulic main is 20 inches in diameter, and each section is separated from the adjoining sections by a space of 12 inches, the gas take-off being from the back, leading to an auxiliary main, between which and the hydraulic main a gas valve was placed, thus making each section of hydraulic main entirely independent of every other section, an arrangement which secures many advantages. By this plan the disturbance to the main from expansion of brickwork, with the resulting



Elevation of One of the Benches.

cracking of mains and leaks, and the unsealing of some dips and excessive sealing of others, is obviated. Expensive bracket buckstaves and pockets in back of mains are not needed, for with this plan any bench may be shut off and that section of main cleaned out, while all the other benches continue in operation. In piping out, and where a bench is "let down," the simple closing of a valve completely isolates it from the entire gas making apparatus. When the simplicity and value of this plan are considered, it is a matter of surprise that it has not been more generally adopted.

The water seal process was attached to each section of hydraulic main, the seal on dips being removed after the benches are charged, thus permitting a free passage of the gas from the retorts. The drawing-off of



View of Top of Stack.

the water sealing the dips was accomplished by placing a slide valve in end of each section of main, operated by a lever rod running to within convenient reach of the operator on the floor. The sealing of the dips was arranged by connecting water pipes to each section of main, the water being turned on after the slide valve is closed. In order that an

excessive seal should not occur, through the workman neglecting to close the water valve, a supplementary take-off was attached to the end of each section of main, at a point which allowed an inch seal and no more. The main tar take-off pipes are 6-inch cast iron pipes placed on top of stack. The retorts are 15 × 26 × 9 feet, and easily carbonize 350 pounds of coal with 25 per cent. of the coke.

The general planning of the stack was done by the Company's Engineer, Mr. William Yorke, while the making of the plans and superintendence of construction were by his assistant, Mr. E. H. Yorke.

[Translated for the JOURNAL, by Mr. Herman Poole.]

The Andre System of Gas Heated Ovens.

By P. CHEVILLARD, in *Revue Industrielle.*

In 1893 Messrs. Andre & Co., the well known Lyons specialists, were led to study and apply gas to heating cast iron moulds used in the manufacture of glass lenses. After many experiments they succeeded in building an oven which gave the best of results in active operation in two lens manufactories. This oven being of a very limited use, Messrs. Andre & Co. studied the wider application to ovens for bakers and pastry cooks, the analogy being very close as to form and construction. Many attempts have been made in this direction, but, as far as we know, the ovens invented have not so far given results sufficiently satisfactory to warrant their use.

The question is actually of importance, since heating bakers' ovens by wood, coal or coke presents many serious inconveniences, as, for instance, loss of time necessary to obtain the requisite temperature of 300° C., necessary to the baking; irregularities of temperature; insupportable heat in the bakeshop; difficulty in keeping the oven and the shop clean; frequent cleaning of the flues; danger of fire; increased insurance rate of the shop and fixtures; and difficulty of establishing a bakeshop wherever desired.

Messrs. Andre & Co. claim that the use of gas in heating the ovens will attain economic advantages and ameliorate the condition of the employees, who are obliged to work in very high temperatures and at times almost naked.

The arrangements they have devised allow the circulation of the heated gases either exterior to the oven (as in Figs. 1 and 2), or inside the same (as in Fig. 3). In either case, the exterior appearance is that shown in Fig. 4.

In the arrangement for exterior circulation of the gases, the oven proper, *A*, which is made preferably of a round shape, is provided with two walls, one, *B*, is opened in its superior part and surrounded at a certain distance by the other wall, *C*, which consists of two parallel walls, having between them a space filled with a non-conducting material, mineral wool, asbestos, etc., so as to prevent loss of heat by radiation.

The interior wall, *B*, is prolonged around the oven in such a way as to form a flue, partly occupied by a gas burner arranged concentrically, and serving to heat the oven. The extension of the exterior shell, *C*, in its turn forms around this flue a closed chamber *D*, carrying two pipes diametrically opposite, *E E* (Fig. 4.)

These two pipes empty behind the oven into a horizontal pipe, from the middle of which rises the chimney E^{11} (Fig. 5). In the box, *e*, formed at the base of this chimney, is placed a gas jet, reached by means of the door, e^1, and causing a draft which draws out the cold air contained in the walls and assists in lighting the burner.

In order that the products of combustion give up the greater part of their heat to the oven, and that their utilization may be as near maximum as possible, are placed, alternately, between the ovens and the interior wall, diaphragms, *r r*, as well as between the two walls themselves, so that no part of the shell is free from these stops, not even the charging door itself.

In this manner the hot gases emitted by the burner follow the course around the oven in a zigzag way, in the direction indicated by the arrows in Figs. 1 and 2, and gradually lose their heat while circulating and ascending, at first among the diaphragms of the oven and the wall, *B*; then descending among those which are placed between the two walls.

After having accomplished this double course, and having become deprived of most of the heat, the gases flow into the chamber *D*, which surrounds the flue of the burner, and then escape by the opposite pipes, *E*, to the chimney, E^{11}.

To prevent the burning out which would be produced by the direct contact of the hot gases on the bottom of the oven a screen has been placed between the burner, and this at short distance off. This is formed of two plates, *G;* between which are placed non conducting material. Besides, on the oven bottom and inside of it, is placed a sole of refractory material, and carrying ribs below it, which produce a good circulation of the heat and a regular baking of whatever bread and pastry may be placed in the oven.

The regulation of the burner and the supervision of its working are obtained through the doors, *S* and S^1, attached the lower part of the shells, *B* and *C*, respectively. They allow also the lighting of the burner by means of a dummy placed near them.

The burner represented in Figs. 6 and 7 consists of two single burners, having a single central tube, *I*, of one and two concentric tubes, I^1, of the other, expanded at the summit so as to receive a crown of jets directed obliquely in the same course. Naturally, the number of concentric crowns may be augmented so as to make the power of the compound burner equal to that needed for any size of oven, but each one must be carefully separated from its neighbor by an annular space, running the whole length of the tubular part of the burner, and serving to cause an air current.

At the tops and at the bases, these burners are provided with a metal gauze. The upper one is to prevent the return of the gas and the lighting of the injector, the lower one to prevent the air forming too rapid currents, which would interfere with the normal draft.

The whole is supported on a frame and legs of cast iron, or on brick columns. At *M*, in Fig. 4, we see the charging door, the handling of which is rendered easy by means of a balanced lever, M^1. The flow to the burners *I* and I^1 is regulated, respectively, by the cocks, *N*, N^1, placed in front, by the door. Above is a pyrometer, *R*, showing continually the temperature of the oven, and below the cock controlling the dummy light. When charging or emptying the oven, the interior is illuminated by means of a swinging gas jet, *P*.

The variation represented in Figure 2 differs from the preceding arrangement only by the omission of internal wall of the oven. Further, the diaphragms, r^1, which are cast projecting from this wall, are not placed vertically, but so inclined that when they meet the gas currents they are deviated and deflected down on the materials being cooked in the oven.

We thus draw a larger portion of heat than in the preceding arrangement, where the hot gases circulate completely on the exterior of the oven shell proper; and, besides, the construction is cheaper. In either case the cast iron interior wall may be replaced by one of refractory material.

Messrs. Andre & Co. were inspired with the same principle in the construction of a small domestic oven, in which can be well cooked pastry, roasts, etc. We see three models of oval form, in Figs. 8 to 11. The first is mounted on feet, and is heated by a duplex gas burner with a dummy; while the second one, without feet, may be heated by gas flame or by a charcoal furnace (Fig. 10).

In these two cases the circulation of hot gases is exterior to the oven, *A*, which for this purpose is provided with two walls, *B* and *C*, covering as in the preceding cases diaphragms arranged alternately, which arrangement is also carried out in the walls of the door (Fig. 9).

A screen, *G*, formed of two plates with intervening non-conducting material, is disposed below the oven, and at a short distance from the burner, to prevent overheating of the oven floor, is placed a refractory plate, *L*. This carries not only ribs, L^1, designed to promote a good division of the heat, but further lateral projections L^{11} (Figs. 12 and 13), which form contact with the walls of the oven, and have around them space for the circulation of the heat from below upwards.

Fig. 11 shows that, by the omission of the internal wall, we obtain a domestic oven with internal circulation of hot gases. The oven is then pierced circularly with a large number of holes, *Z Z*, through which the gases pass to the oven. Besides, the floor of the preceding is substituted by a grill, *H*, with a movable plate, J^1.

In these three arrangements, the course of the circulating gases is exactly indicated by arrows, and we see that after their utilization, they escape to the open air. Non-conducting arrangements may be applied to the outside, and this is a matter of price; for ovens to be sold cheap, they may be made as indicated in our figures.

At the beginning of this article we said that Messrs. Andre & Co. had been led to study these different ovens by the invention of an oven for heating lens moulds. These moulds weigh from 31.5 to 38 lbs., and are heated to a temperature of 100° to 125° C., in 7 minutes, and are cooled down again in about the same time. The expense of gas should not exceed 23.4 cents for 12 hours' work.

It has been necessary to modify this apparatus which we represent in Fig. 14, with appropriate arrangements. This oven consists of a spherical shell simulating the form of the moulds to be heated. The

GAS HEATED OVENS. **Messrs. Andre & Co. System Ovens for Bakers and Pastry Cooks.**

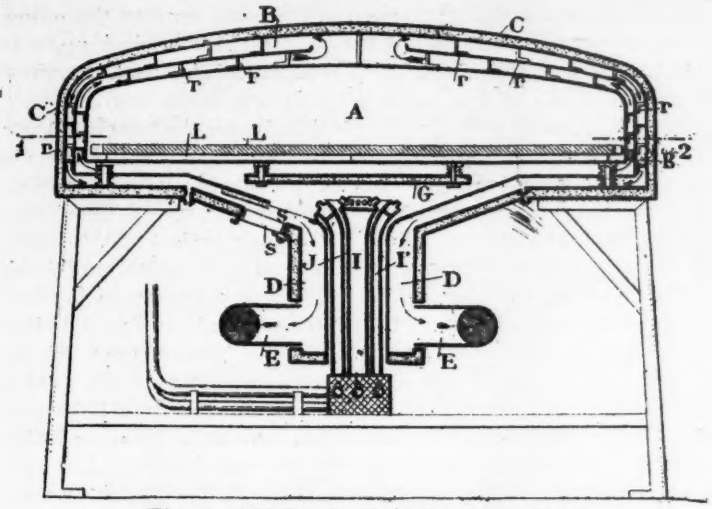


Fig. 1.—With Exterior Circulation of Heated Gases.

Fig. 6.
Duplex Burner.

Fig. 7.

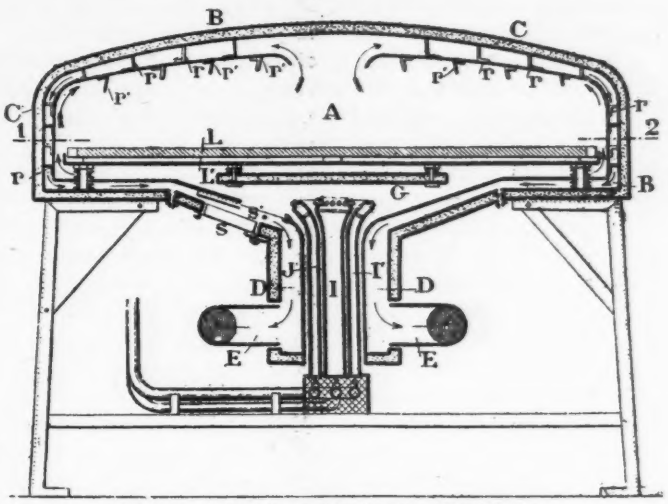


Fig. 3.—With Interior Circulation of Heated Gases.

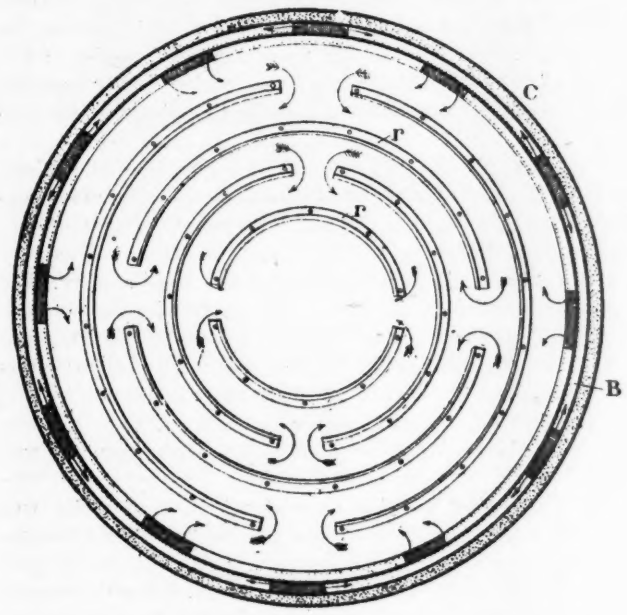


Fig. 2.—Transverse Section on Line 1—2.

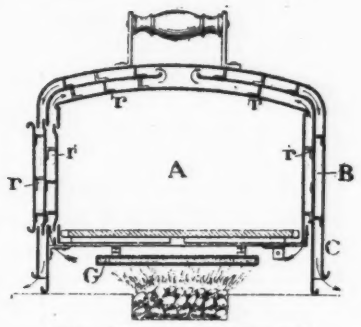


Fig. 10.—For a Chafing Dish.

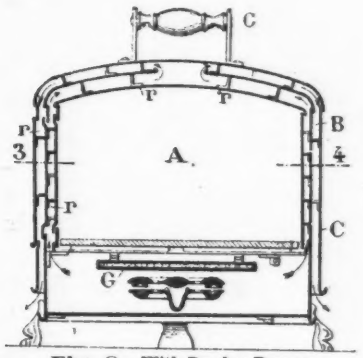


Fig. 8.—With Duplex Burner.

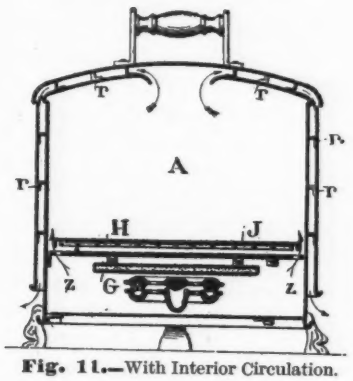


Fig. 11.—With Interior Circulation.

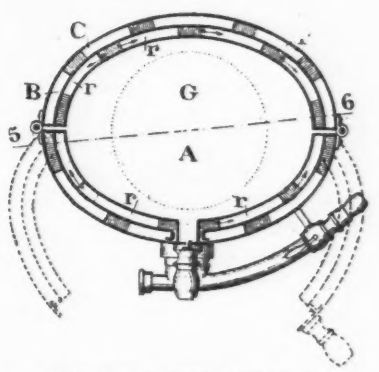


Fig. 9.—Horizontal Section, 3—4.

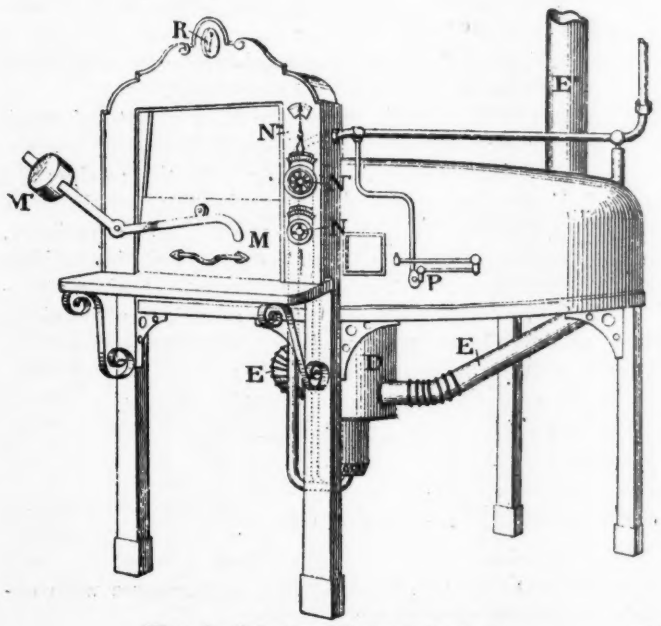


Fig. 4.—Baker's and Pastry Cook's Oven.

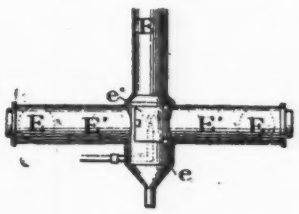
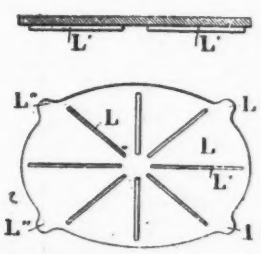


Fig. 5.



Figs. 12 & 13.—Refractory Floor with Ribs.

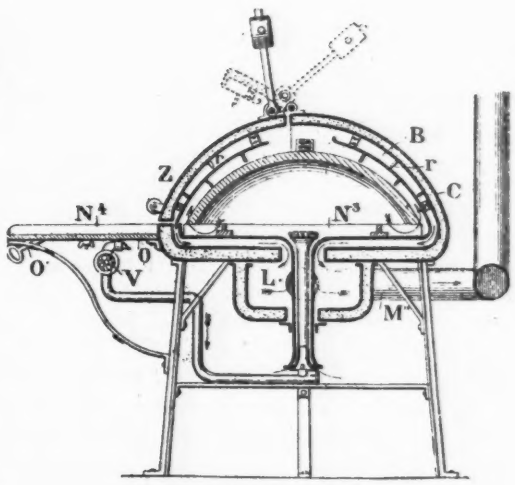


Fig. 14.—Oven for Lens Makers.

same as in the preceding, the first wall is open in its upper part, so as to give the gases a double circulation. But its prolongation to the base consists of a bottom plate, having a central opening, through which passes loosely the head of the burner, the regulation of which is by means of the cock *V*. The double exterior shell is provided with a layer of non-conducting material. In front this oven is closed by a convex door, *Z*, which is worked by means of a counter poised lever.

Here the gases strike directly the bottom of the heating mould, descend towards the base, then rise to the exterior. Alternate diaphragms, disposed in the walls *B* and *C*, oblige them as before to lose their heat. They then pass into the chamber *Z*, and by means of the side pipes M^{11} to the chimney.

The moulds rest in the oven on two longitudinal iron supports, joined together and fixed in the lower part of the wall *B*. A table, *O*,

carries two similar irons, N^4 forming a prolongation of the two former ones, N^3. The door opened the moulds are pushed in in contact from the table by means of the arm, O^1, which thus admits of introducing and sorting the moulds easily and without fear of accident.

This oven has stood the test of practice. It is to be presumed that the oven for bakers is not inferior to it, since at the Congress of Clermont-Ferrand, held in June, by the French Society of Gas Engineers, Mr. Andre announced that an oven of the type shown in Fig. 11 with interior circulation of gases, produced an economy of gas of about 20 per cent. over the ordinary ovens.

It would be interesting to make full experiments with a large baker's oven, say of 11 to 13 feet diameter. So far Mr. Andre can only make predictions. He estimates that heating with wood causes an annual expense of 67 cents for six daily heats of 210 to 262 lbs. of bread, and cooking the same 40 minutes. To raise and maintain an oven to the same temperature of 300°, and to produce the same output, would require only 40 cents with gas at $1.05 per 1,000 cubic feet; and thus during the year an economy of $232.60, due one-half to the heating itself and one-half to the elimination of the expense of the wood-house, the cleaning of flues, the cartage of wood and the removal of ashes.

A few hours only suffice to put up a baker's oven, measuring 5 feet in diameter; and there is an annual economy in favor of gas of about $15.00. Another advantage which cannot be expressed in figures is the notable amelioration of the hygienic condition of the workmen.

Regenerator Furnaces for Small Gas Works.

[A paper read by MR. W. B. RANDALL, of Waltham Cross, England, before the Southern District Association of Gas Engineers and Managers.]

About three years ago, owing to causes which need not here be detailed, it became necessary for my directors to build a new retort house, and I was instructed to investigate the matter and prepare plans and estimates for the same. Some little experience in working a generator furnace having satisfied me that it had advantages over direct firing, the next step was to consider the advisability of regenerator firing, and to adopt this principle in its entirety. One cannot but be struck with the number of systems in vogue at the present time, each one claiming superiority; and with a view to selecting the most economical method, I visited several works where regenerator furnaces had been for some time in use, and, by the courtesy of those in charge, was enabled to form a clearer idea of the respective merits of the various principles.

Local conditions, present and future, size of works, etc., having been duly considered, the writer advised the erection of regenerator settings of eight horizontal retorts, 22 inches by 16 inches by 10 feet, D's, with stage-floor retort house. Four arches or beds were set in July, 1894. Two of the producers of these were arranged on the "open hearth," or ordinary system of drip plates and fire bars, with ashpan underneath, and two on the closed or "solid hearth" system, with primary air inlet and two ashpans at the sides, as shown by the drawings—the two systems being adopted in order to decide which best suited our requirements. The arches are all of the same size—viz., 16 feet high from crown of arch to top of concrete; 8 feet 9 inches wide between the side walls of the oven; and 10 feet 6 inches deep from the face of the front wall to the face of the back wall—the stage floor line being 9 feet, and the clinkering floor 18 feet from the crown of the arch. The buttress or end walls are 41 inches; the division or oven walls, 18 inches; the back of stack, 27 inches; and from the crown of the arch to the top of the retort stack, 30 inches. The main flue is 36 inches high by 24 inches wide at the bottom of the arch.

For convenience of description, the term "open hearth" is used to indicate the settings having drip plate fire bars and ashpan underneath, and "closed hearth" to mean the settings without fire bars but with side ashpans. The "open hearth" producers, and the secondary and waste gas flues, are built entirely of ordinary Stourbridge bricks and quarries or tiles, without grooves, tongues or rebates of any description to assist in keeping the flues from bye-passing or short circuiting. The size of the producer is 6 feet high, 2 feet wide and 4 feet long at the bars, holding about 5 feet depth of fuel when filled. The waste gas flues are arranged on each side of the producer and oven walls to run in double horizontal tiers, with the secondary air flue "sandwiched" between them. The producer arch runs from front to back of the setting, with two rows of secondary air and carbonic oxide nostrils, the whole length. A combustion chamber of large special arch blocks in three segments is here formed, and these, together with the two bottom retorts, which rest upon the regenerator flues, carry the 9-inch piers or walls which support the other retorts. The middle retorts are bedded immediately above the bottom ones; and the space between the crown of the bottom retort and the bed of the middle one is bricked up, with the exception of a 1½-inch space each foot run. The heat, therefore, rises to the top of the setting, splits at the crown of the arch and travels down, passing away to the waste gas flues under the bottom retorts.

The "closed hearth" producer, and the secondary and waste gas flues, are built entirely with special silica bricks and quarries or tiles, with grooves, tongues and rebates, and jointed with special fireclay cement to prevent any short circuiting. The producer is 5 feet 6 inches high, 2 feet 8 inches wide, and 4 feet long at the hearth, and holds about 4 feet 6 inches depth of fuel when filled up. The waste gas flues are arranged one on each side of the oven wall, and run in single horizontal tiers; the secondary air flue being formed between the waste gas flues and the side of the producer. The area of the waste gas flues is about 190 square inches, and that of the secondary air flues 126 square inches. The producer arch runs from back to front of the setting, with secondary air and carbonic oxide nostrils the whole length. The combustion chamber is divided into two compartments by a 9-inch wall, which is built on the center of the producer arch, and is carried up to support the center middle retort, thus practically forming a double combustion chamber. The travel of the gases, and the mode of setting the retorts, are almost similar to those in the "open hearth" settings; but over the *last* waste gas flues an ashpan is fixed, which, being supplied with water, should form sufficient steam to make the clinker quite friable.

The above details will give some idea of the construction of the settings; but my intention is to deal more particularly with the actual experience of the two settings during the last two years. Our make of gas is now about 31,000,000 per annum, with districts which are rapidly increasing in population as Greater London extends its boundary. We have an abnormal demand for coke in the neighborhood, as it is largely used for horticultural purposes—one florist taking over 7,000 tons per annum from Beckton, etc., so that the increased amount of coke resulting from the introduction of regenerator furnaces would not in our case cause any depreciation of prices, as for some years past we have been compelled to buy large quantities of coke in order to keep our customers supplied.

On completion of the retort beds by the contractors, a slow fire was put under two beds, one of each system, and the heat allowed to escape at sight boxes just under the crown of the arch. After the retorts were fairly dried it was necessary to open the dampers and cause the heat to travel on its appointed way—a matter not so easily arranged as written about. The work being all new, or "green," the difficulty was to get the shaft or chimney, which is 60 feet high, to induce a draught. This was accomplished by means of a steam-jet; but I was heartily glad when the shaft showed a vacuum. Though this episode is not likely to occur again with this bench, I should be pleased to hear from others as to the best and safest means of dealing with the subject.

The beds being now fairly started, one of the daily objects of a gas manager's life had to be dealt with—viz., to obtain the correct temperatures in various parts of the setting. Starting with the producer, I found most conflicting evidence as to the correct heat to be maintained to obtain a maximum production of carbonic oxide. But experience, aided by an analysis of the producer gases, soon showed that a high temperature in the producer gave the best results in the setting. Theoretically, 1,100° F. should give the best results; but in practice about 1,800° F. in the producer is necessary with us. The composition of the producer gases by volume per cent. is as follows:

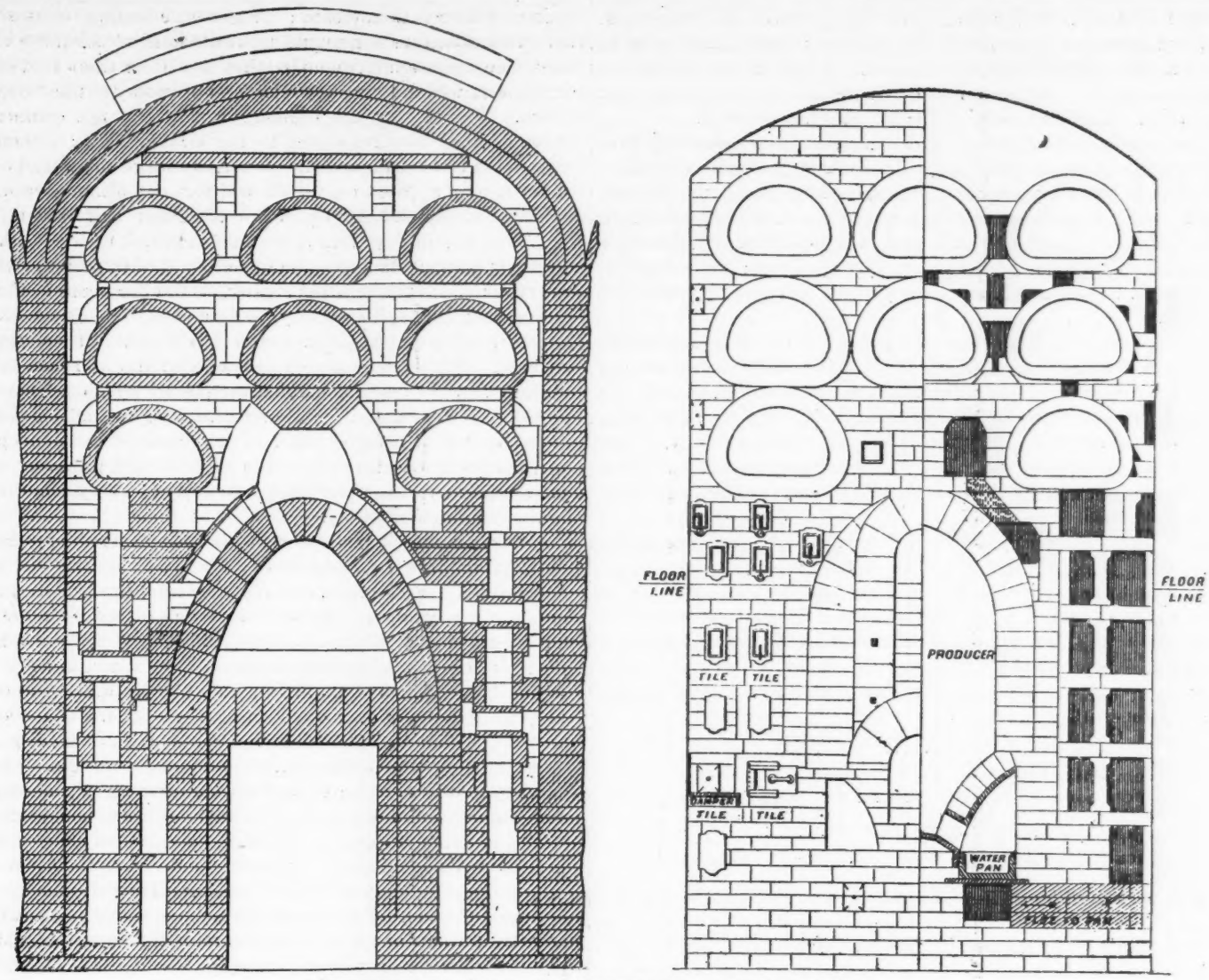
Carbonic oxide (CO)	25.70 per cent.
Marsh gas (CH_4)	2.75 "
Hydrogen (H)	14.06 "
Nitrogen (N)	52.74 "
Carbonic acid (CO_2)	4.75 "
	100 00

With the producer at this heat, the following temperatures were obtained at various points of the setting:

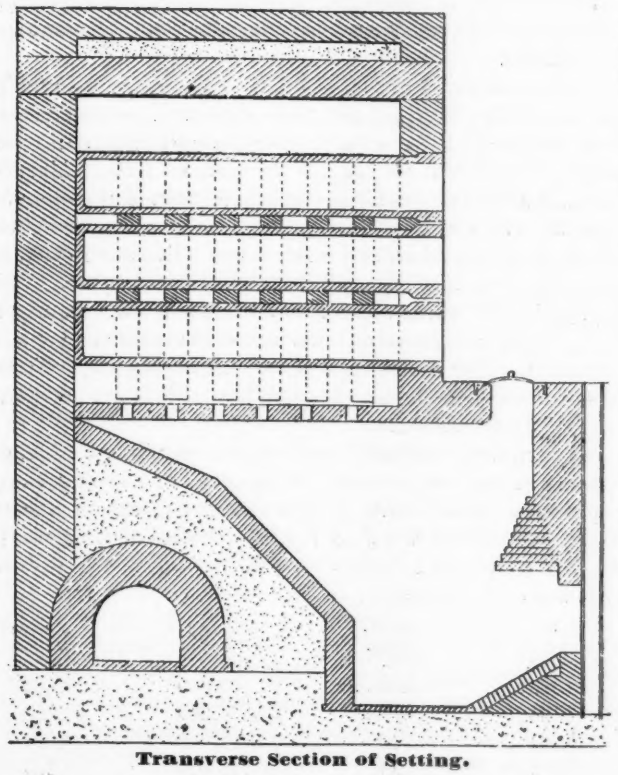
Combustion chamber	2,600° F.
Crown of oven	2,400° F.
Entrance to regenerators	2,150° F.
Outlet of last waste gas flue	1,000° F.

So that about 1,150° are taken up by the secondary air, and in raising the necessary steam for the producers.

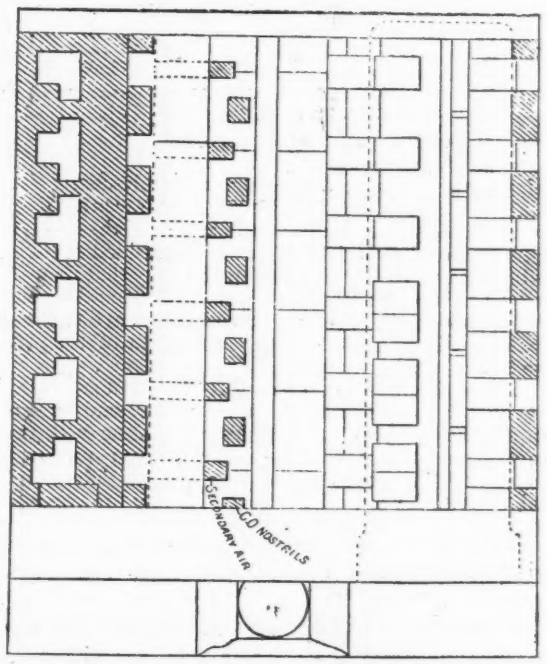
I anticipate that all engineers and managers will not agree as to the advisability of working at these high temperatures, from the producer



Arrangement of Oven for Stage System of Retort Setting.



Transverse Section of Setting.



Section howing Bed of Outside Bottom Retorts.

to the last waste gas flue; and although sundry professional friends have prophesied that high temperatures would not pay in the end, we still agree to differ. To my mind the test of the whole matter lies in the results obtained—in the shape of gas made per retort in its lifetime. This is still to me an unknown quantity, inasmuch as, although we have been working over 800 days continuously with one of the beds of retorts ("closed hearth" system), it is still in good condition, and at the present moment making over 8,000 cubic feet per mouthpiece in 24 hours. To put it another way, each retort has made nearly 6½ million cubic feet of gas, and carbonized about 600 tons of coal, without any repairs to the setting.

Without doubt, in the direct firing system, a considerable amount of cutting action or local effect occurs in maintaining high heats. But in regenerator firing this should not be noticeable; and so long as one

keeps a safe distance from the melting or fusing points of fireclay materials, there seems no reason why the materials should not wear as long as at a few hundred degrees less heat. Where the mischief undoubtedly occurs is by expansion and contraction in letting down and firing up beds, either for repairs or for the season's working.

As regards coke for fuel, it is remarkable that a coke eminently suited for direct firing was not found so suitable for regenerators, the coke most suitable being of a porous and almost spongy condition. A hard, dense coke becomes coated over with ash, and prevents that entire contact with the air necessary to secure perfect combustion. The smaller the percentage of ash, the better the results obtained; but coke with even 10 per cent. of ash, so long as it is porous, will give very good results indeed.

The vacuum required depends on the nature of the fuel employed; about $\frac{2}{10}$ or $\frac{3}{10}$ of an inch generally being sufficient at the last waste gas flue. Of course, a great deal depends upon the adjustment of the dampers, and the admission of the secondary air. A good illustration of this adjustment is seen in the ordinary brazing forge burner, where by the increase of blast or secondary air, the flame is shortened and made more intense, and by its decrease the flame is lengthened and made less intense.

From the temperatures previously given, it will at once be seen that we do not admit a large proportion of secondary air—preferring to keep all the eight retorts at as uniform a heat as possible. The effect of a large proportion of secondary air is to cause an intense heat in the retorts over the combustion chamber; while the two bottom retorts, and the waste gas flues also, are rendered correspondingly dull. An average analysis of gas drawn from the last waste gas flue will help to make matters clearer.

Carbonic oxide	00.70
Carbonic acid	16.00
Oxygen	....
Nitrogen	83.30
	100.00

Several tests, under various conditions, have been applied as to the amount of fuel used and gas made by both systems; and in all cases the "closed hearth" results are better than those obtained by the "open hearth." The following actual working results may be taken as a fair average of a series of tests made with the "closed hearth," and extending over several days:

Number and size of retorts	8 ⏀ 22 in. by 16 in. by 10 ft.
Coal carbonized in 24 hours	6 tons 18 cwt.
Total gas made in 24 hours	72,000 cu. ft.
Gas made per mouthpiece in 24 hours	9,000 "
Gas made per ton of coal in 24 hours	10,500 "
Coke produced	4 tons 18 cwt.
Coke used as fuel in producer	18 cwt.
Coke used per 100 lbs. of coal carbonized	13.04 lbs.
Coke used per cent. on make	18.36 per cent.
Coke made per ton of coal carbonized	14.0 cwt.
Coke used as fuel " "	2.6 "
Coke salable, without deducting fuel for boilers	11.4 "

The above results were obtained from unscreened Durham coals, as supplied in the South of England—coal so small as oftentimes to make one wonder if only the screenings are sent Sonth. We have obtained better results than those quoted when pushing the settings and using a fair sized South Yorkshire coal; but I prefer to give results which can be maintained week by week.

In addition to the above, the saving of probably the most arduous labor of a retort house with direct firing, and certainly the most detrimental to the heat of a setting, is rendered a comparatively easy task. I refer to "clinkering"—a process performed every 24 or 48 hours, according to the percentage of ash in the coke and the temperature required in the retorts.

Here again the superiority of the "closed hearth" was easily seen; and for this to be understood it is necessary to explain that, about 18 inches from the hearth, a bridge or arch of clinker, springing from the two sides of the producer, gradually forms, and during the clinkering acts as a support to the firing in the producer. The object to be accomplished is to generate or admit just sufficient steam to reduce the ash or clinker to a friable and dusty condition. This is carefully withdrawn by a small rake, when a light steel bar breaks the supporting arch of clinker, and clears off the sides and back any which may have been too hard for the rake to remove (and which it is found an advantage to leave at the bottom of the producer for the next 24 or 48 hours). The clinkering door is then closed; the two side ashpits cleaned out; and no further attention is required until the next occasion for clinkering. The whole operation frequently takes less time than that occupied in placing and withdrawing the false bars necessary in the "open hearth" system. Besides this, the clinker or ash does not contain any pan breeze, and can be taken direct to the clinker heap; whereas the pan breeze from the "open hearth" contains a large amount of coke which for the sake of appearance we sift and pick out, although at the present low value of coke it hardly pays for the labor bestowed on it. With the "open hearth," we find it necessary to prick up and shake the bars every few hours; otherwise the fire clinkers over, and an excess of secondary air passes through the setting, to the detriment of the heats.

The producers are filled every four hours by drawing the charge from the center middle retort (and center top retort, if necessary) into the producer. This also is a very easy operation, and remarkable for its simplicity. It will be noticed that the hopper which is seen under the mouthpiece of the center middle retort, hinges and falls forward on the top producer door being opened. The shoot is placed at such an angle that the coke gravitates well to the back of the producer, and as this causes less labor than taking the coke away to the yard, the producers are always kept well filled.

In drawing, the charges are raked into iron barrows and taken direct to the other end of the retort house, where the barrow with its charge is placed under a sprinkler, and the coke cooled. It is most important not to allow any water to be used in front of the bed, otherwise the splashes and steam make it difficult to keep the front wall airtight, and are apt to cause fracture in the producer mountings.

The considerable saving of labor in clinkering and firing up enables a larger number of retorts to be charged per man. The average daily make of gas exceeds 30,000 cubic feet per man, in addition to the attention to the boiler and exhauster, the rate paid being $1.25 per shift of 12 hours, while the average carbonizing (including yard) wages for the last six months work out under 52 cents per ton of coal carbonized.

Since adopting regenerator settings, our yield of ammonia has considerably fallen, and cyanogen compounds have therefore increased. But, owing to the very low price obtained for sulphate of ammonia, the loss on the yield of ammonia has not so much affected the system as it would have done if prices had remained firmer. Against this loss there is this set off—viz., we are being paid a small amount for each ton of coal carbonized by a firm who are supplying oxide to arrest the sulphureted hydrogen, and especially the cyanogen compounds which are formed with the higher temperatures obtained by regenerator firing; whereas previously we were paying for loan of oxide per ton of coal carbonized.

We also find a diminished yield of tar since using higher temperatures, which perhaps is not to be regretted, as there is no doubt that the volume of tar is reduced by converting some of the benzol and naphtha (the light oils) into a permanent gas. This is done in one operation, and seems more reasonable than the employing of another system of retorts to convert them into gas; and when we reflect that benzol is an enricher, and now worth $1.18 per gallon, it behooves us to keep as much of it out of the tar wells as possible. The tar distillers complain of the free carbon found in the pitch from our tar; and as it is interesting, samples of pitch are on the table for your inspection and criticism. This system probably furnishes another method for the self-enrichment of coal gas. I may add that it is not patented or even provisionally protected.

As regards choked or stopped ascension pipes, we had some difficulty when first starting the regenerator system; but by even charges, steady gauge and seal or dip, and especially by using an auger or button of full size, we have not had a badly choked or stopped pipe for some months past, and I trust that such a thing will eventually become nothing but a memory.

Year.	Coal Carbonized. Tons.	Total Gas Made. Cubic Feet.	Gas Made per Ton. Cubic Feet.	Number of Consumers.
1892	2,486	25,169,000	10,124	500
1893	2,413	25,862,000	10,718	539
1894	2,702	28,572,000	10,574	762
1895	2,880	31,210,000	10,842	880

The above tabulated statement will show the progress during the past four years; and to it must be added a substantial reduction in the price of gas, from $1.12 to 95 cents per 1,000 cubic feet, an extra 1 per cent. dividend on the original shares, and a large proportion paid off the suspense account created by building the new retort house.

In conclusion, it will probably be noticed that any reference to patentee or contractor, or cost of settings, has been carefully avoided.

The interests of the Association should prevent any paper from reading like an advertisement; but should any members desire information on these points, I shall be pleased to communicate with them privately.

The Analysis of Coke.

[A paper read by Mr. GEORGE C. DAVIS, at a meeting of the Foundrymen's Association, held in Philadelphia.]

Coke plays so important a part in the production of iron and steel in all stages of the process, and may so largely affect the quality of the product, that it becomes almost a necessity to be able to determine upon its suitability for use in blast furnrce or cupola. The furnace manager wishes to know the percentage of sulphur and phosphorous present, as well as the amount and composition of the ash. In a blast furnace practically all the phosphorus from the coke is found in the pig metal. In the cupola the conditions are different. Let us assume that it requires one pound of fuel to melt seven of iron. I know that my placing the ratio of iron to coke at 7 to 1 will be criticised, but I am convinced that this is nearer the truth than the 16 to 1 ratio we hear of from some foundrymen and politicians. Assuming our coke to contain 0.03 per cent. phosphorus, which is higher than any sample I have ever analyzed, it follows that the percentage of phosphorus in the pig would not be increased more than 0.004 per cent. So small an increase as this would be of no importance even in malleable work, and as I am speaking to-night with especial reference to foundry practice, I think we may eliminate the determination of phosphorus in coke from among the numerous things the foundryman has to worry over.

In the cupola the amount of slag is small, and may vary widely in composition, provided it is fluid. Except in long runs in large cupolas the slag is not tapped out, and little attention is paid to it. In fact, I am afraid that many small users of iron omit the limestone altogether, and the result is often a badly stuck up cupola which requires some time to repair when a few pounds of limestone would have prevented the trouble. The usual practice is to add from 20 pounds to 40 pounds of limestone per ton of pig. This amount is ample to flux the sand adhering to the pig and to supply any deficiency of base in the coke ash. We conclude, therefore, that it is the amount of the ash that is of most importance to the foundryman, and it is the so-called proximate analysis of coke that I shall describe to you. In work of this kind it is very important that the conditions should always be the same. The necessity for this is still more marked in soft coals, where a slight change may produce a large difference in results, but for sake of uniformity we treat all samples of fuel under the same conditions. To determine the moisture, from 1 to 2 grammes of the finely-powdered sample are weighed out into a platinum crucible and dried for one hour at a temperature of 100 to 105° in an air bath. While this is being done, another sample is weighed into a platinum crucible and ignited for 3½ minutes over a Bunsen lamp, and then for 3½ minutes over a blast lamp. After cooling in a desiccator and weighing, the loss is calculated as moisture and volatile combustible matter. In a like manner our first sample gave us the moisture, and by subtraction we find the percentage of volatile combustible matter. The second sample is now ignited until all the carbon is burnt off, when by again cooling and weighing we have the ash. By adding together the percentage of moisture, volatile combustible matter and ash, and subtracting from 100 we have the amount of fixed carbon. The time of ignition, seven minutes in all, in determining the volatile manner was fixed some years ago by the chemist of the Iowa Geological Survey by a series of experiments, and has since been adopted by nearly all the chemists in this country. Unless the coke has been carelessly made the amount of volatile matter will seldom exceed 2 per cent. I recently had a sample of poor coke containing over 4 per cent. volatile combustible matter, but this was exceptional. Such coke has a tendency to burn out too quickly in the upper part of the charge, but this phenomenon is much more noticeable in a blast furnace than in a cupola. It does not always follow that a coke lowest in ash is the best. I have noticed that the purer cokes are often weak and crushed easily, while those containing an average amount of ash, say 8 per cent., gave much better economy, as there was less loss in breeze.

For determining sulphur there are two methods, and the one I shall describe, which is probably the more often used, is known as the Eschka method. We take one gramme of coke, and after mixing well with 1½ grammes of Eschka mixture, which contains two parts calcined magnesia and one part of dry carbonate of soda, transfer the whole to a platinum crucible. About one-fourth gramme more of Eschka mixture is poured on, and the crucible inclined on a triangle. Heat is now applied rather slowly at first, and in the course of an hour the coke will have burnt off, leaving all the sulphur present in combination with the soda. The process is hastened by frequent stirring with a platinum wire. After cooling the crucible is placed in hot water and kept warm a few minutes. The magnesia is insoluble, while the sodium salts pass into solution. By filtering we get rid of the magnesia. To the filtered solution is now added a little bromine water and 3 cubic centimeters of hydrochloric acid. The bromine ensures the complete oxidation of the sulphur to sodium sulphate, while the acid decomposes the excess of sodium of carbonate present. The solution is now concentrated by boiling; the excess of bromine and carbonic acid gas passes off and we are now ready to throw down the sulphur, as sulphate of barium, by adding a soluble salt of barium. The barium sulphate is a heavy, white precipitate, which settles to the bottom of the beaker. We now filter off the precipitate and wash with hot water, place filter and precipitate on a crucible and heat gently until the filter is charred. By increasing the heat the filter is burned off while the barium sulphate, which contains 13.76 per cent. of sulphur, remains. After cooling in a desiccator the precipitate is weighed and percentage of sulphur calculated as usual. In coals sulphur exists in combination with lime as gypsum; with iron as pyrites or with the carbon compounds as organic sulphur. In the process of analysis part of the sulphur is driven off with the volatile matter, a part remains with the fixed carbon, while the rest remains with the ash. It is impossible to correctly apportion the sulphur among these, so it is reported separately. Coke usually contains from ½ to 2 per cent. of sulphur. In the cupola a part of the sulphur is always taken up by the iron, but the addition of lime and hot melting have a tendency to prevent this, for at a high temperature lime has a greater affinity for sulphur than iron. Fortunately many of the West Virginia cokes run low in sulphur, 0.60 per cent. and under, giving the foundryman a much purer coke than was formerly obtainable.

Corrosion Caused by Railway Return Currents.

[By Mr. DUGALD C. JACKSON, in *Electrical World*.]

In 1894 I presented before the Western Society of Engineers, the results of the investigations in the electrical laboratory of the University of Wincorisin, upon the processes brought about by the return currents of electric railways, which cause corrosion of iron pipes that lie in the path of the currents. The panicky condition at that time existing among electric railway managers and the owners of underground pipes and cables (caused by exposures of the extent of the trouble which had been and which might still be brought about by electrolysis due to railway return currents) has been allayed by means of a reasonable examination of the subject, while reasonable precautions against electrolysis have been quite generally taken in this country, so that the dangers from its effects, which were originally pronounced by some to be unavoidable, have been in practice reduced to a reasonably negligible minimum.

As the effects of electrolysis must be continuously guarded against, the subject is still of sufficient interest to warrant detailing the results of experiments to determine the differences in the reactions which occur when lead and iron are respectively the metal of the anode upon which the corrosion takes place. These experiments were carried out during the winter of 1895-6, by Messrs. Scott and Van Ness, in the Wisconsin University laboratory. The experiments of two years earlier, carried out by Messrs. Biefield and Silber, and referred to above, were made the foundation of the new work, but lead anodes were used instead of iron, the cathodes being of iron in both sets of experiments.

The problem set before experimenters was:

1. To determine the character of the chemical action set up by electrolysis between a lead anode and an iron cathode under the conditions that occur in the ground where corrosion occurs to lead pipes or cable coverings by the electrolytic action of railway return currents.
2. To determine the rate of corrosion.
3. To compare the chemical reactions and the rate of corrosion when the anodes are respectively of iron and of lead.

The results of these experiments fully substantiate the deductions drawn from the original experiments carried out by Biefield and Silber. The chemical reactions occurring during electrolysis with the lead anode are exactly such as would be inferred from the earlier experiments; and the corrosive action is again proved to be uninfluenced by the actual E. M. F. applied, except as this controls the amount of current flowing, so that the rate of corrosion is alone dependent upon

the amount of the current flowing within the critical amount and the nature of the salt composing the electrolyte. The following table (Table I.) gives the averages of three runs with electrolytic cells having lead anodes, iron cathodes and an electrolyte composed of sand moistened with various salts :

Table I.

Electrolyte. Sand moistened with	Loss per ampere-hour. Grams.
Sodium nitrate	4.10
Ammonium nitrate	3.82
Potassium nitrate	4.38
Sodium sulphate	2.18
Sodium chloride	2.09
Ammonium chloride	2.12
Potassium chloride	1.89
Sodium carbonate*	1.20
Ammonium carbonate*	1.14
Average of nitrate salts	4.10
Average of sulphate salts	2.18†
Average of chloride salts	2.03
Average of carbonate salts	1.17

* Only one run. † Only one salt (sulphate of soda) tested.

In each run the order of activity of the salts was nitrates, sulphates, chlorides, carbonates. A comparison of these results with those of the earlier experiments, where iron anodes were used, shows that the order of activity of the salts is different for the two kinds of anodes, as would be expected from purely chemical considerations. The order of activity found in the earlier experiments using iron anodes was chlorides, nitrates, sulphates. The following table (Table II.) shows the average losses at the anode per ampere-hour, according to the two sets of experiments. The loss is considerably greater in each case with the lead anodes, as would be expected.

Table II.

Salt.	Lead anode.	Iron anode.
Nitrates	4.10	.89
Sulphates	2.18	.66
Chlorides	2.03	1.33
Carbonates	1.17	.00

The results of these experiments, which were carried to too great a length to detail fully, lead to conclusions which are virtually a paraphrase of the conclusions based on the earlier set of experiments with iron anodes and which were previously published :

1. The destructive corrosion of the anode is due to secondary chemical reactions brought about by the electrolysis of some salt held in solution by the water of the soil, and not by direct oxidation resulting from the electrolysis of water.

2. Corrosion takes place wherever a current is leaving the pipe or cable covering, however small the difference of potential may be ; and the rate at which lead is removed from the pipe or cable covering is dependent solely upon the strength of the current and the nature of the salts present in the soil about the pipe or covering.

3. A very small quantity of the salt is sufficient to start the action when a current flows, and the chemical reactions are regenerative and continue as long as the current continues to flow.

4. Corrosion will occur with the smallest possible difference of electrical potential, provided the earth's resistance permits any current to flow.

In my previous paper upon this subject (two years ago) I presented certain recommendations based upon the results of experiments and upon experience with electric railway circuits which, if followed in the construction and operation of such circuits, would prevent dangerous corrosion. Many electrical railways made use of the suggestions, and a satisfactory evidence of their utility is presented in a pamphlet on "Electrolytic Deterioration of Water Pipes," lately issued by the National Board of Fire Underwriters, which contains virtually similar recommendations apparently based upon the results attained during the interval which has elapsed, in which an effort has been made to apply preventive measures against destructive corrosion.

A Successful Method Devised for Dissipating Naphthaline Deposits.

By Mr. E. H. Yorke.

A recent sudden and general stoppage of the consumers' services of the Company with which the writer is now connected, called for a prompt and effective method for not only arresting the trouble, but of dissipating the naphthaline stoppages already existing. Whether the method devised had ever before been employed, I do not know ; but feeling assured that it will be new to a number of gas superintendents, I venture to describe it.

These stoppages were as unaccountable as they were unwelcome, and occurred under conditions that were more unfavorable to their appearance than had existed for many years before ; for the reason that new and more efficient apparatus had just been installed for the proper and better manipulation and gradual condensation of the gas.

The deposits were of a most stubborn character, and, in many cases, refused to yield to every known treatment, including local application, necessitating the digging up of the services.

The remedy which suggested itself was that of vaporizing naphtha of about 70° gravity and sending it out with the gas. To that end a steel tank, holding 20 gallons, was obtained and located in the purifying room. A pump was located in the purifying cellar, the draught end of which was connected with a barrel of naphtha and the discharge end to the tank.

The top of tank was connected with the pipes connecting with the gas mains, thus permitting the tank to be filled without having any opening to the atmosphere. A glass tube on side of tank showed at all times the amount of naphtha in tank. Underneath the tank was placed a glass oil cup for the purpose of noting the amount of naphtha being run. From this cup connecting pipes were run to both the inlet and outlet pipes of holders.

A little experimenting demonstrated that the best results were attained by passing the naphtha into the outlet pipes. During the daytime the naphtha was only allowed to pass out by drops, but as the night consumption commenced the discharge was increased until a small stream was running.

Each day after this arrangement was put into operation there was a constant diminution of the number of service stoppages, and at the end of about the seventh day they disappeared altogether. We have, however, continued injecting a few gallons each day, fearing that if we did not do so the enemy might return. That the naphtha became quickly vaporized was evidenced by the fact that a photometer situated within 100 feet from the point where the naphtha entered the gas mains showed a candle power far beyond the capacity of the photometer. During the sendout of about 200,000 cubic feet of gas, we injected into the gas mains as much as 30 gallons of naphtha without there being any detectable odor from the gas while burning.

With this same method we also wholly removed an almost complete stoppage from naphthaline in a 12-inch inlet to one of our holders.

Cause of Luminosity in Incandescent Mantles.

The *Gas World* prints an account of a series of experiments made by Dr. C. Killing, of Germany, which were instituted by him to determine he cause of luminosity in incandescent mantles. The author says Dr. Westphal found that bare heating of the oxides, as in a platinum crucible, did not result in luminosity, even when oxygen was played upon them ; and that Dr. Bunte attributed the luminosity to fineness of structure and refractoriness of the material, together with heat conductivity and rapid assumption of a high temperature, while there were also probably chemical reactions at work. Dr. Killing's experiments have led him to conclude that the luminosity is not due to admixture of oxides, but to the presence, in a state of extremely fine division, of the added oxide in the skeleton, consisting of the main substance, such as thoria. Results of the same order may be obtained by coating a perfectly pure thoria skeleton, which gives scarcely any light, with a very thin skin of ceria, by dipping the thoria mantle into an alcoholic solution of ceria nitrate ; but with yttria or erbia laid on in the same way there is no such result. With oxide of uranium, however, in the proportion of about ¼ per cent. nitrate mixed with the thorium nitrate in solution, the light is good, not far behind that of a thoria-ceria mantle ; but if the proportion be raised to 1 per cent. the mantle becomes useless. It appears that only those substances have the required enhancing effect in which there is more than one state of oxidation ; and that the action is a catalytic one, in which there is a carrying-to, and a liberation of, oxygen. Metallic platinum acts in much the same way as oxide of cerium ; and one drop of a 5 per cent. solution of platinum chlorite in 10 c.c. of a 40 per cent. solution of pure thorium nitrate brings the light up to ten times the value it has when pure thorium nitrate is employed alone. In that case the mantle consists of 9⅝ grains of thoria and 0.004 grains of platinum ; and there can hardly be in this case a molecular mixture, nor could the entire burden of the luminosity be borne by such a small quantity of platinum. When a liter of water is put over a Welsbach burner without a mantle it gains 21.9° C. in 10

minutes; with a pure thoria mantle 19.7° C.; and with a luminous thoria-ceria mantle only 16.2° C. The combustion is perfect in all three cases; so that there is a considerable drain upon the heat in the production of light in Welsbach mantles. If iridium be used instead of platinum, in the author's experiments, the result is still better; the iridium is much less fusible than platinum, and the mantle lasts longer. Gold, osmium, palladium, rhodium, and ruthenium act in a similar way; but osmium and palladium very soon disappear, leaving nothing but the feebly luminous pure thoria. That there is some catalytic action of the kind described may be seen in a platinum-thoria mantle; if it be hot, when the gas is turned on again it becomes hotter and glows; this glow begins at the top, and may run half down the mantle before the gas is kindled. A Welsbach mantle occasionally presents a similar phenomenon when everything is hot; but the catalytic action of ceria or of uranium oxide seems to be more marked at higher temperatures, while that of platinum appears at relatively low ones. Many other metals, if they have more than one oxide, act, to some extent, in a similar manner; chromium, iron, cobalt, manganese, molybdenum, nickel, vanadium, and tungsten will do this; but only those are useful which can withstand the high temperatures to which they will be exposed. Chromium and pure thoria start almost as bright as a Welsbach mantle, but in 3 minutes there is a fall off, for chromium evaporates away, and in 15 minutes it is gone. The utility of ceria lies, therefore, in its lending itself to this catalytic action, and in its refractoriness; and the platinum metals must also pass through different stages of oxidation and reduction. The supporting skeleton may consist of other substances than thoria; one consisting of 70 per cent. zirconia and 30 per cent. lime will make a mantle that can be used when the catalytic and refractory material is added to it. The proportion of ceria should not exceed about 1¼ per cent., else the lighting power falls off; but that proportion of ceria will make a bright mantle, with a basis of 75 zirconia and 23¾ lanthania. Probably no oxide, if perfectly pure, would give any more light than corresponded to its actual temperature; but the chemical action involved through the addition, especially of ceria, aids in the transformation of heat into light. The advantages of thoria as a basis depend upon the porosity and enormous surface of its skeleton, and upon its very low specific heat, which property enables it to take up high temperatures, and is itself a consequence of its high atomic weight.

Lubricating Oils.

At a meeting of the Providence (R. I.) Association of Mechanical Engineers, Mr. George R. Babbitt, President of the American Oil Company, addressed the Association on the topic "Lubricating Oils: Of what they are Composed; how Manufactured; Methods of Testing." In the course of his address he said: "Previous to the discovery of petroleum, fish oils were more generally used for lubrication than any other. About 33 years ago petroleum began to be produced in large quantities, but the world was slow to realize its value. There are few places where one cannot get better results with mineral oil than sperm oil. At the time sperm was generally used in cotton mills the spindles ran about 3,000 or 4,000 turns a minute, while now the speed is from 8,000 to 10,000. The lubricant should be adapted to the nature of the work to be done. A very heavy, slow-running bearing requires an oil of density and high in viscosity, and a high fire test. Heavy, quick-running bearings are best lubricated by oils of lighter gravity and high in viscosity; light and quick-running bearings are best lubricated by oils of light gravity and low viscosity. The lighter gravity oils are subject to evaporation, which may result in making them worthless. The animal oils are produced by being pressed from lard, tallow and cattle hoofs. Winter pressed oil means that the material from which the oils are to be pressed is first chilled with ice or mechanical refrigeration, making it clear of stearine matter. This process reduces the quantity of oil that can be pressed from the animal material, and consequently the oil costs more than that known as weather-made oils. Animal oils range from 23 to 24 gravity Baume at 60° F., and are very low in viscosity as compared to mineral oils of the same gravity. When crude oil is taken from the ground it is of a dark red color, but in a mass it looks black or green. The oils from Pennsylvania and West Virginia are the best for lubrication. The best spindle oils are prepared by filtering through bone charcoal. The cheaper lubricating oils are made clear by the parafe or acid process. Paraffine oils, on account of the acids used, stain fabrics. Bone filtered oils are first distilled to the desired gravity, and then percolated through the bone charcoal, placed in a series of pans contained in an upright cylinder. The first oil passing through is white, but as the charcoal absorbs the coloring matter in the oil, the oil begins to show color, light at first and darker afterward. To make clear oils the charcoal must be changed each time, and they are, therefore, more expensive. They are used when the fabric manufactured on the machinery is to be bleached or dyed in delicate shades. Petroleum lubricating oils range from 22 to 40 gravity Baume at 60° F., the flash point being from 300° to 400° F., and their cold test from zero to 35°. Cylinder oils are made from the crude after the lighter or more volatile products have been taken out. The gravity of cylinder oils ranges from 25° to 28° Baume, the flash point from 450° to 580° F., and the cold test from 30° to 60° F. Experience has taught that a combination of mineral and animal oils makes the best cylinder lubricant.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

On the 3d inst. we received a communication on "Water Gas Tar," which bore the signature, "Constant Reader," but it was unaccompanied by the actual name and address of the author. We would like very much to print the article, and in order that publication of it may be made we ask "Constant Reader" to forward us his name and address, neither of which need be made public. The rule of the JOURNAL is not to print anonymous publications, the reason for which course is obvious. We have no doubt that the failure of "Constant Reader" to furnish his name and address was an oversight.

THE proprietors of the Portland (Me.) gas works have been making important betterments to that plant. Notable among the improvements is a scrubber of the Wood type, rated to a capacity of 500,000 cubic feet per day. It is also proposed to construct next spring a double lift holder, to rest in a steel tank, equal to storing 250,000 cubic feet. The contract for this holder has been virtually awarded.

MR. C. M. KELLER, Secretary and Superintendent of the Columbus (Ind.) Gas Light and Coke Company, informs us that recent sales of his adjustable coke crusher included an order from the Peoples Light and Heat Company, of Halifax, N. S. The shipment reported made the fifth machine shipped to foreign countries.

MR. GEORGE N. CURTIS, who had large financial interests in the local gas companies, died in Paris, France, on the 3d inst. His death, which was quite sudden, was the result of a paralytic stroke. The remains will in all probability be brought to New York for interment. He was one of the syndicate that some years ago took over the property and franchises of the Long Branch (N. J.) Gas Light Company, which now forms a part of the Consolidated Gas Company, of New Jersey. He was prominent in the business and social life of New York city. He is survived by his widow, two sons, a sister and brother.

THE Natural Gas Inspector for Indiana (Mr. Leach), having just completed a personal inspection of the wells in the gas field, which inspection was made largely with a view to determining the necessity of obtaining legislation for the prevention of waste, and of instituting reasonable schemes for the reduction of leakage along the gas lines, says that he found the wells were yielding freely, and that he apprehends no scarcity of gas for fuel uses during the present winter, unless the season should be remarkable for its severity.

AT the annual meeting of the Chicopee (Mass.) Gas Company the officers chosen were: Directors, Messrs. J. Howard Nichols, Luther White and James W. Cumnock; President, J. H. Nichols; Clerk, Nathan Crary; Superintendent, C. H. Nutting.

ARTHUR F. KEEFE has instituted suit for $5,000 damages against the Indianapolis Gas Company, on account of injuries received by him while at work in the Company's plant on South Pennsylvania street, Indianapolis. He alleges that he was painting a pipe, and while engaged on that task, when astride of the pipe, which was at a considerable height from the ground, another man shifted the position of the ladder that had been arranged for Keefe's ascent and descent. When complainant attempted to descend, the ladder slipped, and he fell to the ground, crushing both his hips. We report this suit merely to show on what flimsy basis such cases are brought.

RECEIVER O. E. WELLER recently sold at auction all the belongings of the Citizens Gas Light Company, of Reading, South Reading and Stoneham, Mass. The purchaser (nominal) was Mr. John W. Cawley,

who bid $700 for the property over and above all liens, mortgages and taxes. The plant will be operated without interruption.

THE Long Island Gas and Fuel Company has applied to the Brooklyn (N. Y.) Board of Aldermen for the right to construct works and supply fuel gas in that city. The application was referred to the Law Committee, after Ald. Leich, of the Committee on Gas and Electricity had objected to a reference of the petition to his Committee. The main objection by Ald. Leich to the reference was that the Committee had enough to occupy its attention in the consideration of a contract between the city and the Brooklyn Union Gas Company, respecting the rate at which a public gas supply shall be maintained. To an outsider this objection is more or less valid, for the Committee has been trying to arrive at a solution of that contract problem for something less than a year.

THE Crescent Manufacturing Company has been formed in Titusville, Pa., for the manufacture there of gas pressure regulators and gas engines. The active men in the Company are Messrs. W. J. Stevens and C. C. Wright.

A CORRESPONDENT at Port Huron, Mich., writing under date of the 2d inst., says: "The plant of the Port Huron Fuel Gas and Light Company was sold at public auction yesterday by Circuit Court Commissioner Moore, to Arthur G. Bishop, of Flint, Mich., for $18,000. Mr. Bishop, as Trustee, held a mortgage on the property for $18,300, and has been in possession of the plant for the past year. The plant was established about 12 years ago, during the natural gas excitement, by a party of Pittsburgh capitalists, headed by George Wilson. A number of Port Huron people became stockholders; about 8 miles of mains were laid throughout the city and for a time natural gas was supplied to householders from wells on the farm of Charles A. Bailey. The supply of natural gas gave out and for several years the property lay idle. About four years ago a new Company was organized, with George Wilson as President. A piece of property was purchased at the foot of Griswold street and a plant was built for the manufacture of fuel gas under the Archer process and system. Arthur G. Bishop, of Flint, was made Trustee of an issue of bonds emitted for the purpose of securing the funds necessary for the construction of the plant. For a time the concern appeared to prosper under the management of Mr. Wilson, but a year ago he voluntarily retired from the business, and the Trustee assumed nominal charge, the actual management being in the hands of Mr. H. W. Stevens. The sale of yesterday makes Mr. Bishop the sole owner of the property. Mr. Charles A. Bailey and a few other Port Huron stockholders lose all they put in the business. It is understood that Mr. Bishop will improve the plant and go on with the business."

WE understand that the muddle, in respect of a gas supply for Richmond Hill, Long Island, has been cleared up. A franchise for lighting the town has been awarded to the Brooklyn Union Gas Company, and the latter has purchased from the Richmond Hill and Queens County Company all of the latter's property. This consisted largely of pipe laid. The Brooklyn Union Company, it is said, will be ready to furnish gas in Richmond Hill by January 1st.

A FORTNIGHT ago we noted that the City Council of Newport News, Va., had granted a franchise for the operation there of a corporation to be known as the Newport News Gas, Fuel and Power Company. The Mayor (Mr. Moss) subsequently vetoed the franchise. Some of the reasons for such adverse action were: He thought the pipes should be buried at a depth not less than 3 feet from grade surface; that the city should be given the right to purchase the plant at the expiration of 10 years; that the city should be made secure by the filing of a bond in the sum of $10.000. The objections did not seem to have much weight with the Councilmen, who overrode the Mayor's arguments by repassing the franchise by a vote of 11 to 1.

THE Gas Commission will open bids for the public lighting of New York city on the 15th inst.

THE proprietors of the Danvers (Mass.) Gas Company are considering the advisability of lowering the selling rate.

THE proprietors of the Hagerstown (Md.) Light and Heat Company have ordered a reduction in the selling rate, on gas used for illuminating purposes, to $1.60 per 1,000 cubic feet, where the monthly bills show a consumption exceeding 1,000 cubic feet.

UNDER the agreement between the Manhattan Elevated Railroad Company and the New York Safety Car Heating and Lighting Company, whereby the latter is to equip the passenger cars of the Elevated with apparatus suitable for their illumination by compressed oil gas under the Pintsch system, the equipment is to be completed by April 1st, 1897. The generating and compressing plants are to be located at 159th street and 8th avenue.

THE proprietors of the Nathaniel Tufts Meter Company inform us that their offices have been removed to No. 63 Beverly street, Boston, Mass., telephone number, "Haymarket, 430." All communications for the Company should be forwarded to the above address.

MR. A. F. MEEDS, the official gas inspector for Minneapolis, Minn., reports that the illuminating value of the gas supplied in that city for the month of November averaged 24.93 candles. Eleven meters were tested on complaint of consumers, of which two were condemned as fast.

THE death of Captain John P. Tweed, as we are informed by a correspondent, occurred at Fond du Lac, Wis., towards the close of November. The remains were brought to Cincinnati, where interment was made in the Spring Grove Cemetery. His death was due to general decline consequent on old age, he having reached his 89th year. In 1869 he purchased a controlling interest in the Hamilton (O.) Gas Light Company, and was elected President of that corporation in 1870, a position that he retained until the close of 1889.

SOME malcontents in Saratoga Springs, N. Y., are agitating the matter of an opposition gas and electric light supply for that village. There is little likelihood, however, that the project will get beyond the speechmaking stage.

THE proprietors of the Brunswick (Maine) Gas Light Company have brought suit for damages, in the sum of $3,000, against J. W. Fisher, as Treasurer of the village of Brunswick, the claim being based on losses sustained by the Company to its pipes through the construction of a system of public sewers.

THE proprietors of the Freehold (N. J.) Gas Company have reduced the maximum gross selling rate from $2.80 to $2.40 per 1,000 cubic feet.

THE City Council, of Newport, R. I., recently instructed the Committee on Street Lights to enter into a contract with the Newport Gas Light Company for the supply of gas to street lamps and public buildings at its bid of $1.30 per 1,000 cubic feet.

A CORRESPONDENT at Baltimore, Md., incloses the following clipping from a recent issue of the Baltimore *News*: "After 50 years of seasoning under ground, the first gasometer tank ever built in this city, and one of the first in the United States, has been unearthed by workmen on the new Brewers' Exchange building, at Fayette and Liberty streets. The workmen were digging for the foundations for the building, when they struck something hard, which proved to be a gasholder tank, 35 feet in diameter, and solidly built of brick laid in cement. It was harder than quarry rock, and Supt. William Murphy, in charge of the work, said it could not be equaled now as a piece of masonry. The bricks were all hand made, without a flaw, and the walls were grouted in and out. Mr. William G. Pugh, Application Clerk of the Consolidated Gas Company, who has heen with that Company for the past 32 years, remembers the old gasholder tank very well. He said: 'My earliest recollection of this piece of work dates back to 1848, when it was constructed. It was the property of the original Gas Light Company, of Baltimore city, and was built at the site on Liberty street in order to insure a better gas pressure in certain districts. It was the only gasholder erected outside the works proper, which were then located at the southwest corner of Saratoga and North streets. The holders would be looked upon as curiosities at this period or time of gas works construction.' It is an interesting fact that Mr. Pugh's father, David Pugh, designed and constructed the work, as he was at that time superintendent of the works and engineer of the Company. The original works mentioned were constructed by a Welsh gas engineer, who came to America for that purpose. After the erection of the first works Mr. Pugh succeeded the Welshman, and in order to erect his gasholder he put the immense framework on a pair of wheels and moved it to Liberty and Fayette streets."

WE understand that the authorities of Newark, Ohio, have agreed with the proprietors of the Newark Gas Light and Coke Company respecting the terms under which the latter are to supply gas to that city for a period of 30 years. Our correspondent says, regarding the terms of the contract: The ordinary rate for illuminating gas is to be $1.50 per 1,000 cubic feet, gross, with 10 per cent. off for prompt payment within 10 days; the rate for fuel gas to be $1 per 1,000 cubic feet. The Company proposes to rebuild the works next spring.

THE Pittsburgh (Pa.) *Chronicle-Telegraph* says that "Mary McGuinness has entered two suits, on her own account and on the account of Dora McGuinness, against the Pittsburgh Gas Company, for $6,000 and $5,000, respectively. The suits grow out of the death of Mrs. Ann Murphy, the mother of the plaintiff, who died November 22d last from the effects of having been asphyxiated by artificial gas, on October 26th, at 2703 Wylie avenue. Dora McGuinness was asphyxiated on the same night, and it is claimed that she still suffers from the cause mentioned. It is charged that the defendant Company was negligent, in that it maintained a main system that was defective."

AT a recent sale at auction of the 30-year gold bonds of the Newark (N. J.) Gas Company the maximum price paid was on the basis of 125⅛ per cent.

THE success met with by the proprietors of the Norwich City (Conn.) Gas Company, in inducing their consumers to use gas for fuel purposes, has determined them to open a showroom for the exhibition of modern lines of gas cooking, heating and power apparatus.

THE proprietors of the Seattle (Wash.) Gas and Electric Light Company will make important betterments on the plant; in fact, the benchwork is now being reconstructed. The scheme of improvement includes a large addition to the mileage of mains.

ARTICLES incorporating the Standard Gas Company were recently filed in the office of the County Clerk, of Camden, N. J., by Messrs. Thomas W. Synott, of Wenonah, N. J.; John T. Dyer, of Norristown, Pa.; Richard L. Austin, Kenedy Crossan and Nathan Spering, of Philadelphia, and Benjamin F. Archer and George F. Archer, of Camden, N. J. The capital stock is put at $100,000, of which the sum of $30,000 has been paid in. The stated objects of the Company are "to manufacture and sell gas."

THE Pacific Gas Light and Fuel Company, of San Francisco, recently applied to the Board of Trustees, of Sacramento, Cal., for the right to manufacture and distribute gas in that city, and, without much discussion or examination, the franchise was granted. When the ordinance or franchise was sent to the Mayor (Mr. C. H. Hubbard) for his consideration, he returned the same, with the following message:

"I herewith return to you without my approval an ordinance granting a franchise to the Pacific Gas Light and Fuel Company to lay down mains and pipes in and through any and all of the streets and alleys in the city of Sacramento, and for the following reasons:

"*First.*—I believe that the time has now arrived when the city of Sacramento should protect itself in the matter of franchises. Our streets, which are becoming more valuable every year, are the property of the citizens of Sacramento, and we, as officers of the city, are holding these streets in trust for the use and benefit of the people, and as such officers it is the duty of the Board of Trustees and the Mayor to preserve them solely for the interest and benefit of those who placed them in office and trusted them to manage this property. If the right to use our streets and alleys is a grant of value in the market, it is clear that this grant should not be made without just and full compensation. Franchises have in recent years become valuable, and no franchise should be granted or sold by the city, except with the understanding that from and after the commencement of operations under such franchise the city should receive during its existence at least 3 per cent. per annum of the gross receipts arising from such grant. In this instance the franchise was sold for the sum of $25, and a special rate to be extended to the city for gas. We must sooner or later take a firm stand in relation to the granting of these franchises, and I believe that no franchise should be granted under any circumstances unless the city retains an interest in the receipts arising from such grant. Competition is what we want, but we have learned from experience that fierce competition soon leads to consolidation, combination and high prices. One company or corporation will endeavor to drive another out of existence, and the successful one usually makes up for what it has lost by imposing excessive charges upon the people. In all of the large cities of the United States and of Europe this matter of granting franchises is being much considered, for such cities have learned from bitter experience that they have given away valuable franchises which have created gigantic corporations and trusts whose sole aim has been to oppress and to make large fortunes at the expense of the people, and for which the people have never received anything like an adequate remuneration. In Paris, France, no franchise has been granted for many years, except in cases where the city receives a full and fair share of the earnings which are derived from the operation of such franchise, and a large proportion of the expenses of that great city is paid from this income. The city of Glasgow, Scotland, now pays nearly all of her municipal expenses from the revenue derived from the earnings obtained through the operation of franchises granted in that city.

"*Second.*—This proposed ordinance grants to the Pacific Gas Light and Fuel Company the use of all of our streets, which have been improved at great expense to our citizens, for the purpose of laying down pipes and supplying gas for the use of said city and the inhabitants thereof for 25 years, and as a consideration therefor the said Company agrees not to charge more than $1.50 for each 1,000 cubic feet of gas during the first 5 years of this franchise, and that said gas shall not be less than 20 candle power from burners which consume 6 cubic feet per hour. My objection to this is that it may be two or three years before the Company will be able to lay down the pipes and mains, and that, by the time it is prepared to furnish gas, the 5 years will have almost passed, and it will then be at liberty to charge any price which it, or its assigns, may see fit. It seems to me that a maximum charge should be fixed for the time during which the franchise shall exist.

"*Third.*—The proposed ordinance lacks the necessary safeguards for the protection of the best interests of the city. There is nothing in said proposed ordinance requiring the said Company to commence the work of laying the pipes and mains within any specified time, nor is there anything in said ordinance which would compel the said Company to lay down any pipes or mains at all, within the 5 years mentioned therein, as the time during which it is to charge but $1.50 for each 1,000 cubic feet of gas, or at any other time; nor is there anything in said proposed ordinance which would subject said Company to a penalty of any kind in case of failure upon its part to carry out the objects of said franchise. While it is true that Section 209 of the charter invalidates any franchise, unless work is actually commenced within six months thereafter, and, to that extent, protects the city under a grant similar to this, yet I believe the ordinance itself should contain such restrictions on the Company and impose such conditions as to render all dispute a question in the future impossible. I believe it is better, in the grant of the power, to set forth particularly the conditions of the work, when it should be commenced, when completed, how much should be completed within certain periods, and should limit the time within which the Company should actually furnish gas as desired by our people, and any other restrictions in relation to the capital of the Company, its maintenance, operation, etc., which occur to us all in considering the interests of the city. The ordinance, as it now stands, contains a simple grant without any restrictions whatever.

"*Fourth.*—I have not been able to learn who compose the above-named Company, but, without attempting to cast any aspersion upon its motives, it seems as though this franchise is sought for the purpose of obtaining the right to do what the said proposed ordinance permits to be done, but without any obligation upon its part to comply with the terms which it is apparently incumbent upon it to perform, and thus enable it to keep out other competitors, or to sell out its right for a handsome figure. Speculation in municipal franchises should not be tolerated, and no franchise should be granted unless it bears at least some of the earmarks of good faith."

A High Speed Corliss Engine.

Iron Age says that in the Washington mills there is a total of nearly 6,000-horse power, steam and water, and this at times has not been sufficient, as nearly 1,000-horse power was required for driving the electric lighting plant. In order to be as independent of low and back water as possible it was decided to put in an additional engine of about 2,000-horse power. The contract was awarded to the Rice & Sargent Engine Company, of Providence, R. I., and the leading characteristics are: Vertical, inverted, 4-valve, cross compound, surface condensing, thoroughly steam jacketed and provided with a large reheater; diameter of high pressure cylinder, 25 inches; diameter of low pressure cylinder, 50 inches; stroke of both pistons, 36 inches; number of revolutions per minute, 160; piston speed per minute, 960 feet. The shaft

(*Continued on page* 938.)

THE AMERICAN GAS LIGHT JOURNAL

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is of hollow oil tempered steel, and all the main forgings are of the same quality of steel, made very light.

The engine was made condensing because the old engines furnished about all the exhaust steam that can be utilized, and it was made surface condensing in order to keep the condensing water clean for the purpose of using it in the dye house instead of the cold river water, which at present must be heated by exhaust steam. Thus all of the heat rejected by the engine is used in the dye house quite as effectively as if it had entered the water at that point instead of at the engine, with the advantage that much less steam is required for the power than would be required by a non-condensing engine. There is, moreover, less condensation in the engine and less loss of heat between the engine and the dye house than with the non-condensing engine. All heat that enters the engine goes to the dye house except the equivalent of the work done, that lost in the engine by radiation, jacket and reheater condensation, and, of course, that contained in the air pump discharge. By removing the oil from it the heat in the latter can be saved. The cost of coal in running this engine is, therefore, very small. The circulating pump not only sends the water through the condenser, but continues its course to the dye house. The surface condenser has a combined circulating and air pump. There is also an automatic receiver pump for returning the separator jackets and reheater condensations to the boilers, and the exhaust of these auxiliary pumps goes into the exhaust system of the old engines.

The engine will have Corliss valves, but the specfications required the low pressure valves to be worked by positive connections with the eccentric, and to have a fixed cut off at one-quarter stroke, capable, by a change when the engine is stopped, of being extended any amount to three eighths stroke. The valves will be wide open at one-tenth stroke, and the port opening is 12 per cent. of the piston area. The high pressure valves only are to be connected with the governor, and dash pots are to be used on this cylinder and will be closed by steam. The speed of the surface of the shaft journals being great, the bearings were made sufficiently long to reduce the pressure per unit of surface considerably below that occurring in common practice, and ring oiling is to be employed. It may be well to state that in this case the product of journal speed by pressure per unit of surface is far within that common to locomotive driving axle practice.

Automatic Electric Current Meters.

Invention says that pennyworths of electric current are the latest outcome of the penny in the slot machine. The devising of a slot machine to measure out electricity on the same principle as the gas meter slot machine has long been one of the pet schemes of working electricians, and two of their number, Messrs. Bastian and Hodges, have invented such a machine, which has been acquired by the Electric Lighting Extension Syndicate, Limited, of 32 Hampstead Road, London. A number of meters sufficient to supply 400 lights will, it is stated, be installed in the Holbein Buildings, Pimlico Road, Chelsea, a big flat building belonging to the Metropolitan Industrial Dwellings Company. One of the chief promoters is Mr. F. J. Robman, of 11 Adam street, Strand. On dropping a penny in the slot, and pushing a knob, the meter permits the passing of a current of electricity sufficient to run an 8 candle power electric lamp for six hours. You can keep on dropping pennies in the electric meter up to 30, and 180 hours of electricity are placed at your disposal. About five minutes before the pennyworth of electricity is used up, a bell rings, whilst by means of an indicator it can be seen how much electricity has been paid for and is still unused.

The Market for Gas Securities.

As was intimated in the JOURNAL for last week, the Board of Aldermen indorsed the application of the Consumers Fuel Gas, Heat and Power Company for the right to manufacture and distribute fuel gas in this city. The franchise, which is very loosely drawn, in that its possessors promise to perform little, if anything, in the way of gas works construction. The nominal agreement is that the Company will supply fuel gas to the public at the rate of 40 cents per 1,000 cubic feet, the city to obtain its supply at a lower rate. The Company is to pay a bonus into the city treasury of $15,000, and is also to pay to the city the sum of 30 cents for each lineal foot of pipe laid by it through the streets. There are other stipulations of no particular moment, since it seems to us that none of them is obligatory, unless the Company sees fit to observe the promises. The Board, by a decisive majority, the vote being 26 in favor to 4 against, granted the franchise, which is now before the Mayor. The prevail ing impression is that the Mayor will veto it, and the further belief is that the scheme will be passed over his objections. The Board also adopted a resolution appointing a Committee to investigate the gas supply of the city, with a view to reporting as to the advisability of putting the same under municipal control. The Committee named for this task is: Alds. Olcott, Oakley, Hall, Burke, Windolph, School and Goodwin.

Under this influence city gas shares declined sharply, the net loss in Consolidated for the week being equal to 9 points. Other city shares show important shrinkages. We are not alarmists in any sense, and we do not have any grave fears over the outcome of the action of the Board of Aldermen, for at least 3 years would go over before the Consumers Company could make itself felt in the gas supply of the city, even provided that its managers went on forthwith in building, but we do fear the temper of the incoming legislature in respect of naming a maximum rate at which gas may be sold in the future in cities of the "first class." It is conceded that the rate in New York city and Brooklyn is high enough, and it is to be regretted that the Companies did not come to their understanding about the abolition of free piping, cheap gas ranges, and so on, last June rather than this November. However, we have only to repeat that this legislature seems to us to have made up its mind to be a troublesome one in the instance of gas rate revision, for members of it who never rode with the "cavalry" are earnestly discussing the question.

Generally the gas share market is weak, although without good reason outside of New York State. For instance, Chicago is off two points from last week, when the indications of the situation there go to show that it should be higher. Bay State is about as before; but we imagine it will be higher after the 15th inst. Lacledes are somewhat higher. The suggestions to influence the market for these shares, respecting advance news from the Supreme Court of the United States about the case there in which the Company is interested, are little short of scandalous.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

DEC. 14.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	154½	155
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	200	208
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	235	245
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	43½	44
Preferred	2,000,000	100	70	75
Bonds 1st 5's	3,500,000	1,000	105	106
" 1st Con. 5's	1,500,000	..	94	96
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	86	90
Preferred	5,000,000	100	109	111
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109½	..
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	91	91½
" " Bonds (5's)	15 000,000	1,000	105¾	106
Bay State	5,000,000	50	10¾	11
" Income Bonds	2,000,000	1,000	25	30
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000		76
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	74¼	74½
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	70	75
" Bonds	600,000	1,000	100	102

Cincinnati G. & C. Co.....	7,000,000	100	201	202
Consumers, Toronto.....	1,600,000	50	184½	187
Capital, Sacramento.....	500,000	50	..	30
Bonds (6's).....	150,000	1,000	..	..
Consolidated, Baltimore....	1,000,000	100	62	63
Mortgage, 6's.....	3,600,000	..	107	107½
Chesapeake, 1st 6's....	1,000,000	..	..	..
Equitable, 1st 6's.....	910,000	..	..	..
Consolidated, 1st 5's....	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds.....	4,812,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds.....	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	84	86
" Bonds.....	2,000,000	..	85	90
Hartford.....	750,000	25	..	145
Indianapolis.....	2,000,000	..	128	135
" Bonds, 6's.....	2,650,000	..	103	105
Jersey City.....	750,000	20	180	..
Lafayette Gas Co., Ind.....	1,000,000	100	82	86
Bonds.....	1,000,000	1,000	85	90
Louisville.....	2,570,000	50	..	..
Laclede, St. Louis.....	7,500,000	100	24	24½
Preferred.....	2,500,000	100	67	70
Bonds.....	9,034,400	1,000	93	93¼
Little Falls, N. Y.....	50,000	100	..	100
Bonds.....	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.....	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven.....	1,000,000	25	225	..
Oakland, Cal.....	2,000,000	..	52	53¼
" Bonds.....	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage....	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City.....	500,000	50	..	175
Paterson, N. J.....	.....	25	99	102
Rochester Gas & Elec. Co..	2,150,000	50	..	..
Preferred.....	2,150,000	50	83	..
Consolidated 5's.....	2,000,000		87½	90
San Francisco, Cal.....	10,000,000	100	97¾	98¼
St. Paul Gas Light Co.....	1,500,000	100	67½	70
1st Mortgage, 6's.....	650,000	..	84	87
Extension, 6's.....	600,000	..	..	..
General Mortgage, 5's .	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.....	2,000,000	20	250	..
Western, Milwaukee.....	4,000,000	100	63	65
Bonds, 5's	3,556,000	.	90	93
Wilmington, Del.....	500,000	50	180	182

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Kerr Murray Mfg. Co., Fort Wayne, Ind..... 956
Stacey Mfg. Co., Cincinnati, Ohio..... 959
R. D. Wood & Co., Philadelphia, Pa..... 958

DIVIDEND NOTICE.

OFFICE OF WELSBACH LIGHT CO.,
DREXEL BUILDING, PHILA., Dec. 9, 1896.

The Directors have this day declared a dividend of twenty (20) per cent. ($1 per share), payable December 23d, 1895, to stockholders of record at the close of business Dec. 15th. Checks will be mailed.

1110-2 EDWARD C. LEE, Treasurer.

ENGAGEMENT DESIRED.

An English Gas Engineer and Chemist, late teacher of gas manufacture, "City and Guilds of London Institute," author of numerous papers, thoroughly up to date in all departments of coal, oil and water gas, gas lighting, heating, working of residuals, etc., is open to accept appointment as Superintendent, Representative (to reliable firm) or Examiner. Highest references and testimonials as to ability, training, etc. Address, with particulars,

1122-5 "G. A.," care this Journal.

Position Desired

As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1102-tf Address "M. E. J.," care this Journal.

ENGAGEMENT DESIRED.

Gas Engineer, wishing change of location, would like engagement as Agent, Manager or Superintendent.

Address "J.,"

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FOR SALE.

Interest in Coal Gas Plant in Town of 15,000 Population,

with an adjoining town one mile away of 15,000. Works located in Michigan. Small capital required for extension of mains. Control can be had if desired; owner has other interests and cannot attend to both. Plant new. Great chance for man with small capital, if taken at once. Address

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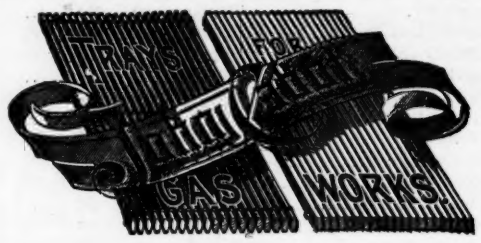

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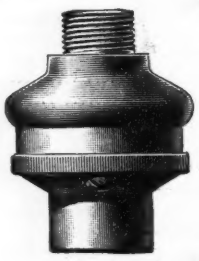

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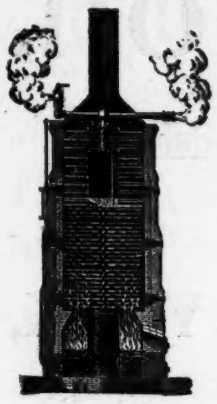

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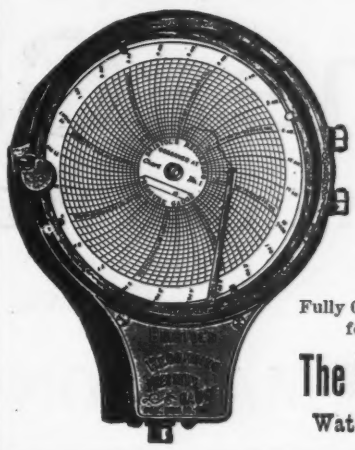

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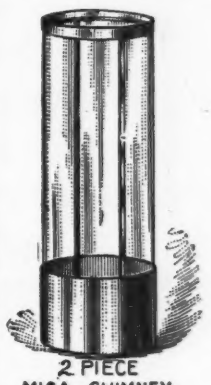

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The Gas Exposition.

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To be Held at MADISON SQUARE GARDEN, NEW YORK,

Two Weeks, Beginning January 25, 1897.

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The Gas Associations have Appointed the Following Representatives:

W. M. EATON, Michigan Gas Asso. **J. A. BRITTON,** Pacific Coast Gas Asso. **IRVIN BUTTERWORTH,** Ohio Gas Light Asso. **GEO. T. THOMPSON,** Western Gas Asso.
C. J. R. HUMPHREYS, American Gas Lt. Asso. **C. H. NETTLETON, New England Asso. of Gas Engineers.**

PROSPECTUS.

THE object of the **Gas Exposition** is to bring together a collection of gas apparatus and appliances of every description, for the two-fold purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years. In submitting the plan of the Exposition to those who may feel an interest in the project, the management would call the attention of manufacturers of supplies of every description, entering into the manufacture of gas, to the great benefits which similar affairs have conferred on the industries of Great Britain, Germany and France, in which countries the exhibitions of gas appliances are held with recurring frequency. The creation of a healthy public sentiment in favor of gas is one of the first aims of large numbers of foreign gas companies.

MADISON SQUARE GARDEN.

In the selection of New York for the inauguration of an enterprise of this character, it is believed that no mistake has been made. In this city the Madison Square Garden is looked upon as one of the great show places of the metropolis; it contains within its walls the requisite space for the proper display of an almost unlimited amount of product, without which an affair of this kind cannot hope for the stamp of public approval—hence the selection of this great building for the inauguration of the gas industries exposition during the two weeks beginning January 25, 1897.

The greater New York contains a resident population of 3,000,000 people. Within a radius of 50 miles of Madison Square Garden live 4,500,000 people; reliable statistics show that an average of fully 100,000 strangers visit New York every day in the year. Thus it will be seen that the gas exposition will draw from a population of fully 6,000,000. In this connection it ma be stated that every effort will be put forth that ingenuity can devise to thoroughly advertise the exposition, and create a desire in the minds of the public to come to the show; and once within its portals the dazzling brilliancy there abounding, coupled with the many attractive and instructive exhibits, will cause the visitor to wish to come again.

It is expected that cooking demonstrations will be a feature of the exposition. The lecture and concert hall, situated conveniently near the great amphitheater, in which the exposition is to take place, affords seating room for 1,200 to 1,400 people. The most experienced and talented ladies obtainable will be selected for this feature of the affair, which must prove one of the show's greatest attractions; not only for the housewives who may be attracted to it, but for gas managers, who will thus have an opportunity to study the advantages these gas cooking demonstrations offer as one of the means at hand for the education of people in the uses of gas.

INJUNCTION ISSUED AGAINST INFRINGERS.

On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES.
} IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

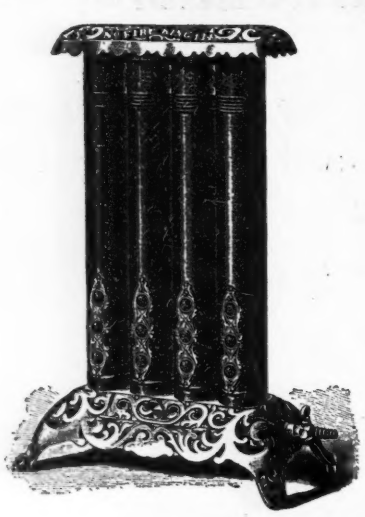
(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

WELSBACH LIGHT COMPANY.

FIRE KING GAS HEATERS.



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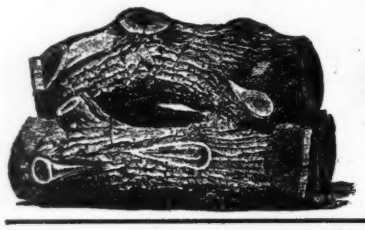

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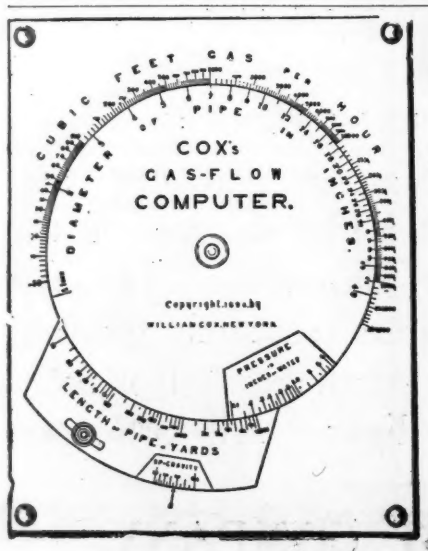

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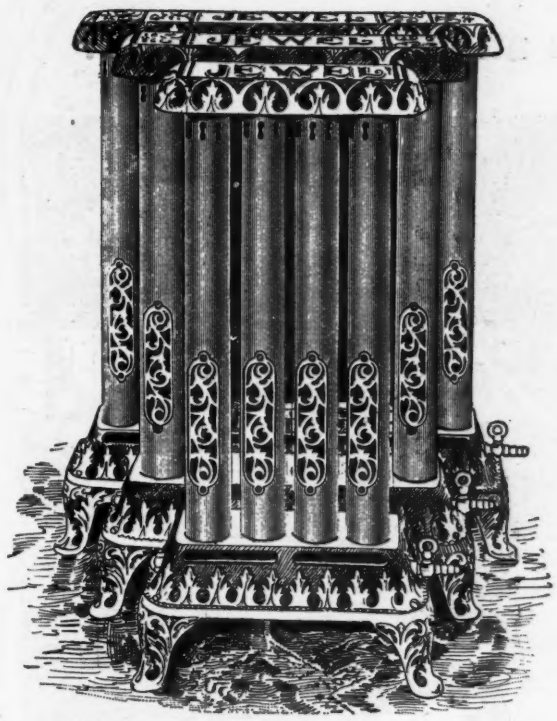

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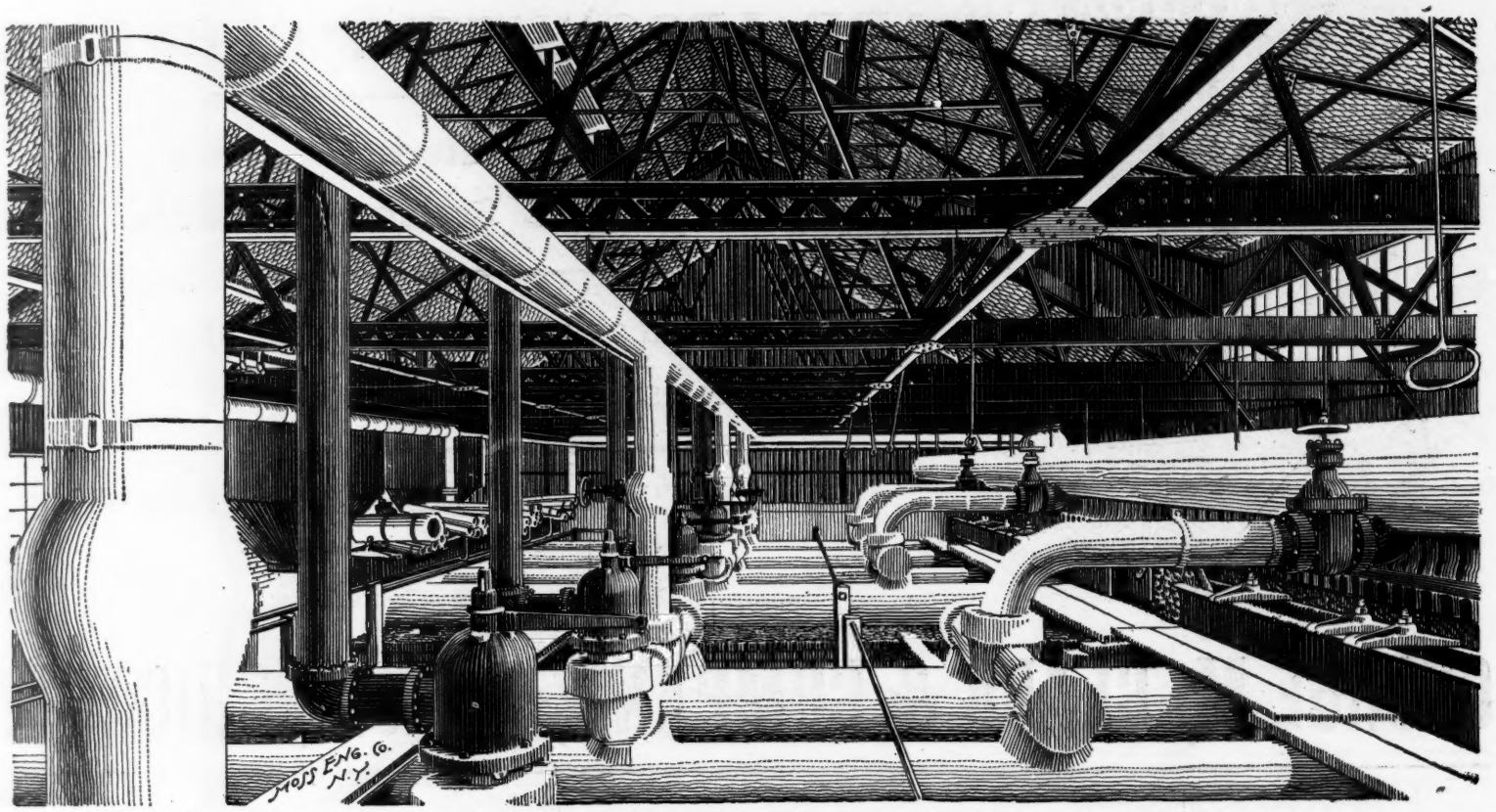

The above illustration is taken direct from a photograph, and shows the construction of a Boiler House designed and built by us for the well known Silk Manufacturing Company, Cheney Brothers, at South Manchester, Conn. The building is 48 ft. in width and 74 ft. in length, with brick walls to the height of the top of the boilers; above that the construction is entirely of iron, the Roof being covered with our Patent Anti-Condensation Corrugated Iron Covering, which we guarantee not to drip in the coldest weather. The construction is absolutely fireproof.

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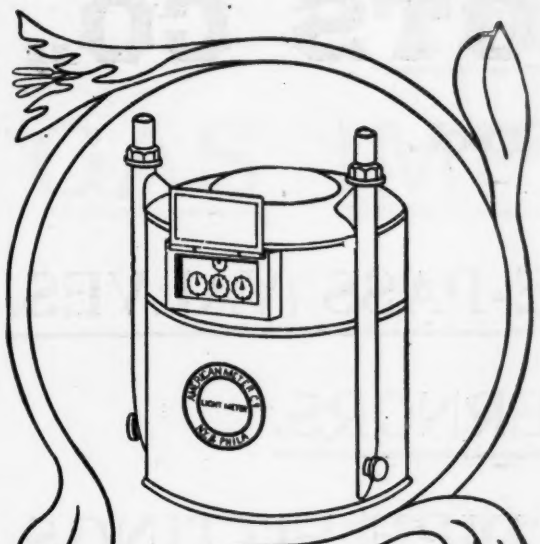
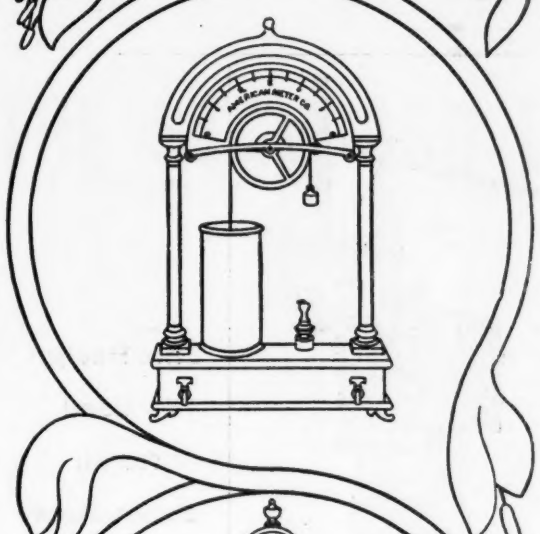
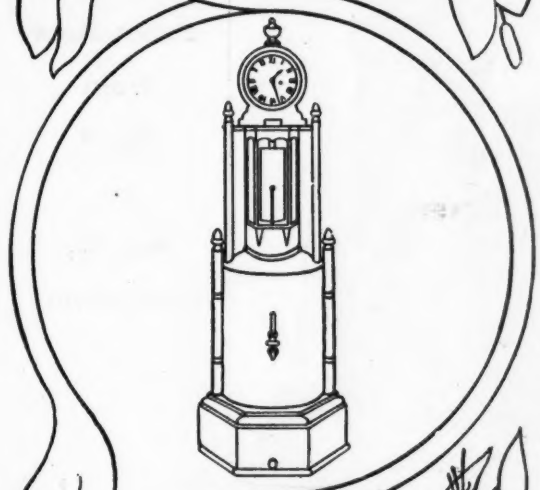
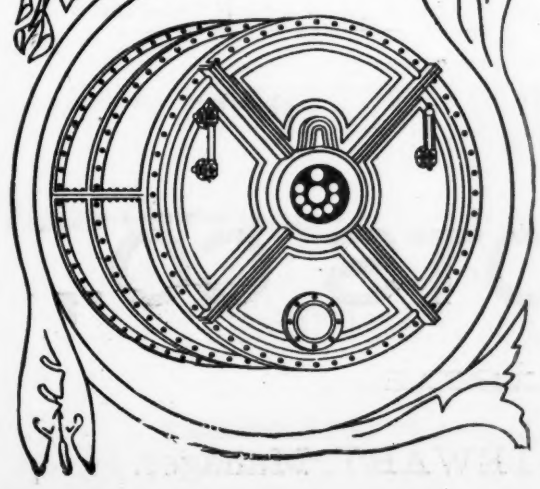








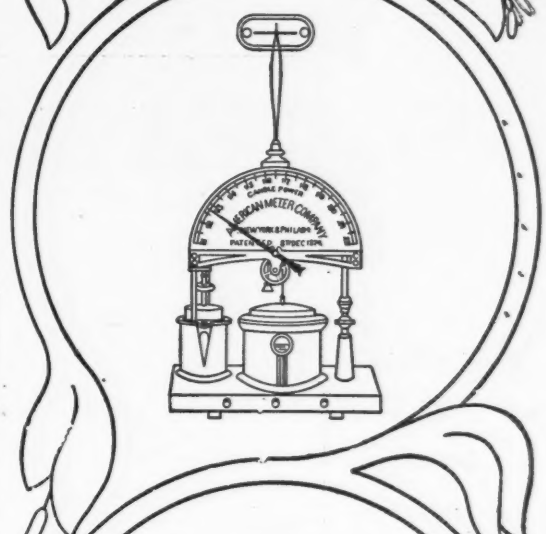
PUBLIC LIGHTING TABLE.

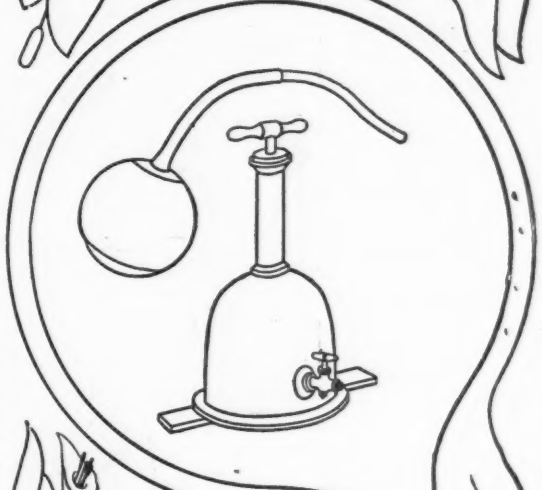
DECEMBER, 1896.

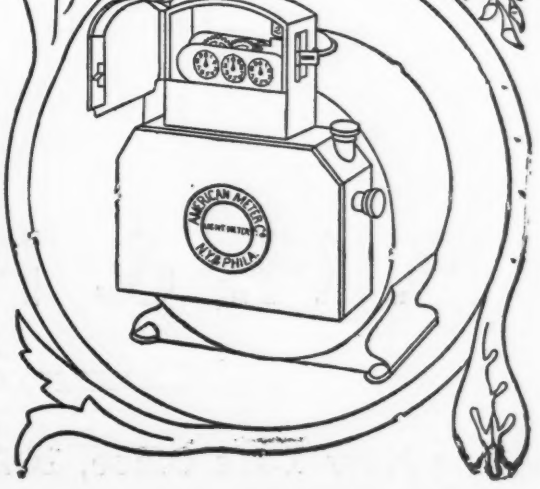
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	5.00 PM	6.10 AM	4.20	6.10
Wed.	2	5.00	6.10	4.20	6.10
Thu.	3	5 00	6.10	4.20	6.15
Fri.	4	5.00 NM	6.10	4.20	6.15
Sat.	5	5.00	6 10	4.20	6.15
Sun.	6	5.00	6.10	4.20	6 15
Mon.	7	5.00	6.10	4.20	6.15
Tue.	8	5.00	6.10	4.20	6.15
Wed.	9	9.00	6.10	4.20	6.15
Thu.	10	10.00	6.10	4.20	6.20
Fri.	11	11.00 FQ	6.10	4.20	6.20
Sat.	12	12.00	6.10	4.20	6.20
Sun.	13	1.00 AM	6.20	4.20	6.20
Mon.	14	2.00	6.20	4.20	6.20
Tue.	15	3.00	6.20	4.20	6 20
Wed	16	4.10	6.20	4.20	6.20
Thu.	17	5 10	6.20	4.20	6.20
Fri.	18	No L.	No L.	4.20	6.20
Sat.	19	No L. FM	No L.	4.20	6.20
Sun	20	No L.	No L.	4.20	6.20
Mon.	21	5.10 PM	7.00 PM	4.20	6.20
Tue.	22	5.10	8.10	4.20	6 20
Wed.	23	5.10	9.20	4.20	6.20
Thu.	24	5.10	10.30	4.20	6 25
Fri.	25	5.10	11.40	4.20	6.25
Sat.	26	5.10 LQ	12.50 AM	4.20	6.25
Sun.	27	5.10	2.00	4.20	6 25
Mon.	28	5.10	3.20	4.20	6.25
Tue.	29	5.10	4.30	4.20	6.25
Wed.	30	5.10	6.20	4.20	6.25
Thu.	31	5.10	6.20	4.20	6.25

TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00







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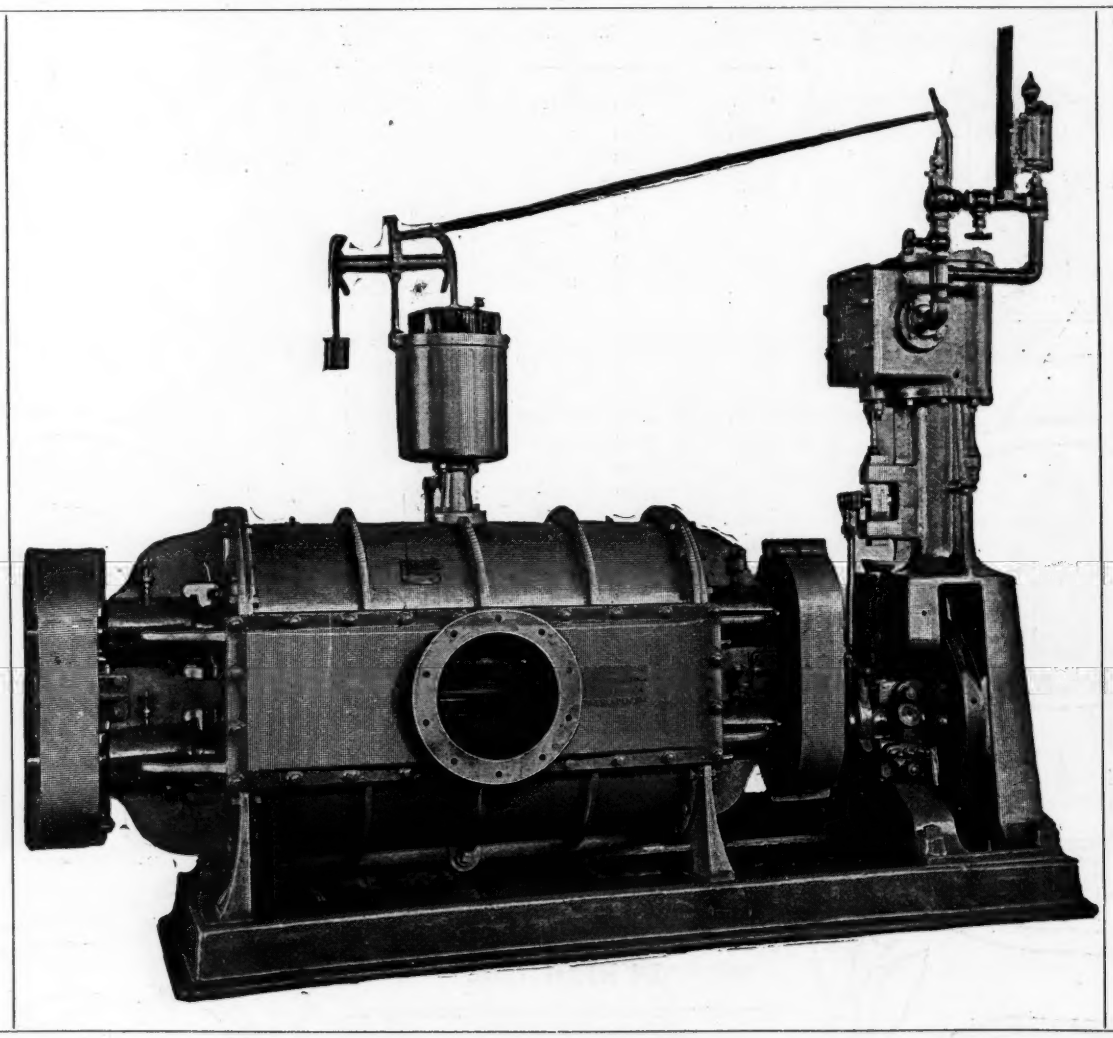

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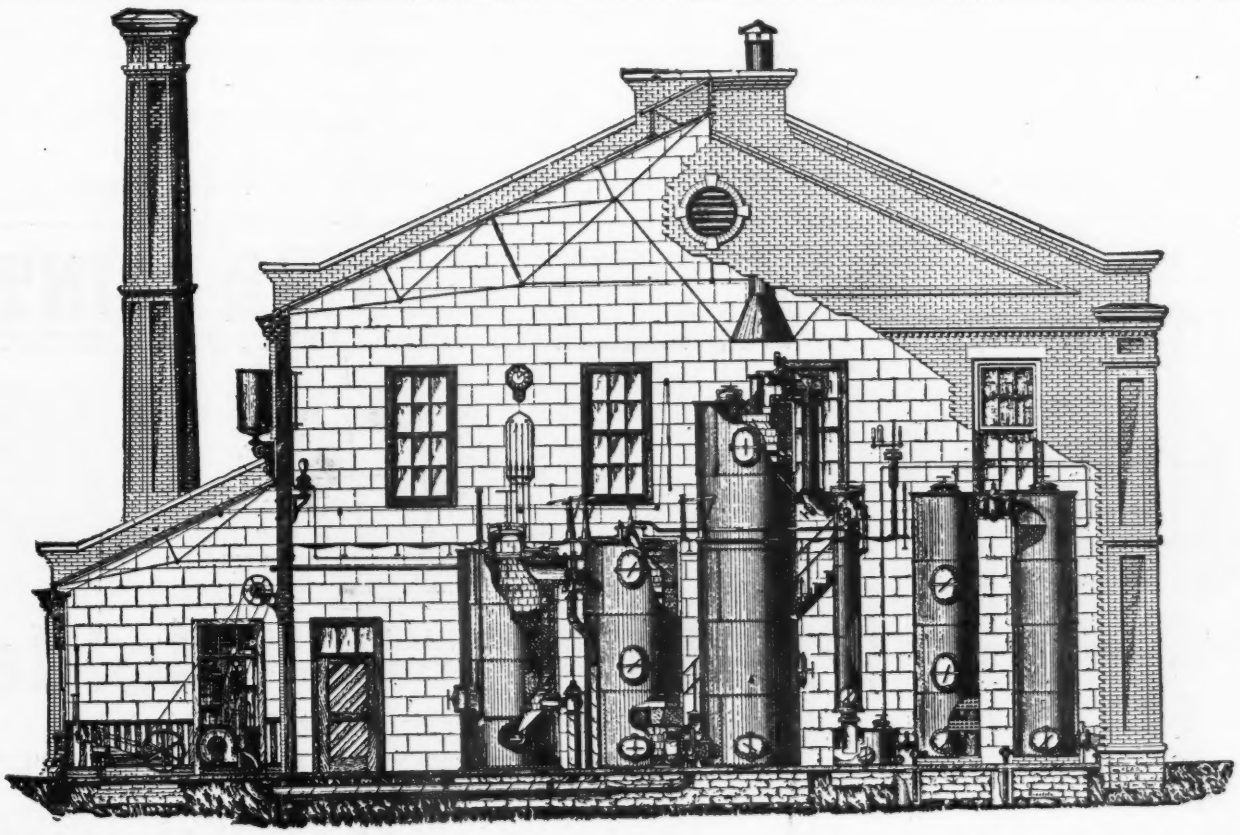

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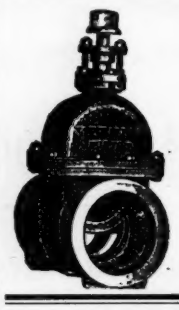

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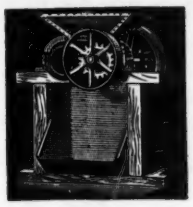

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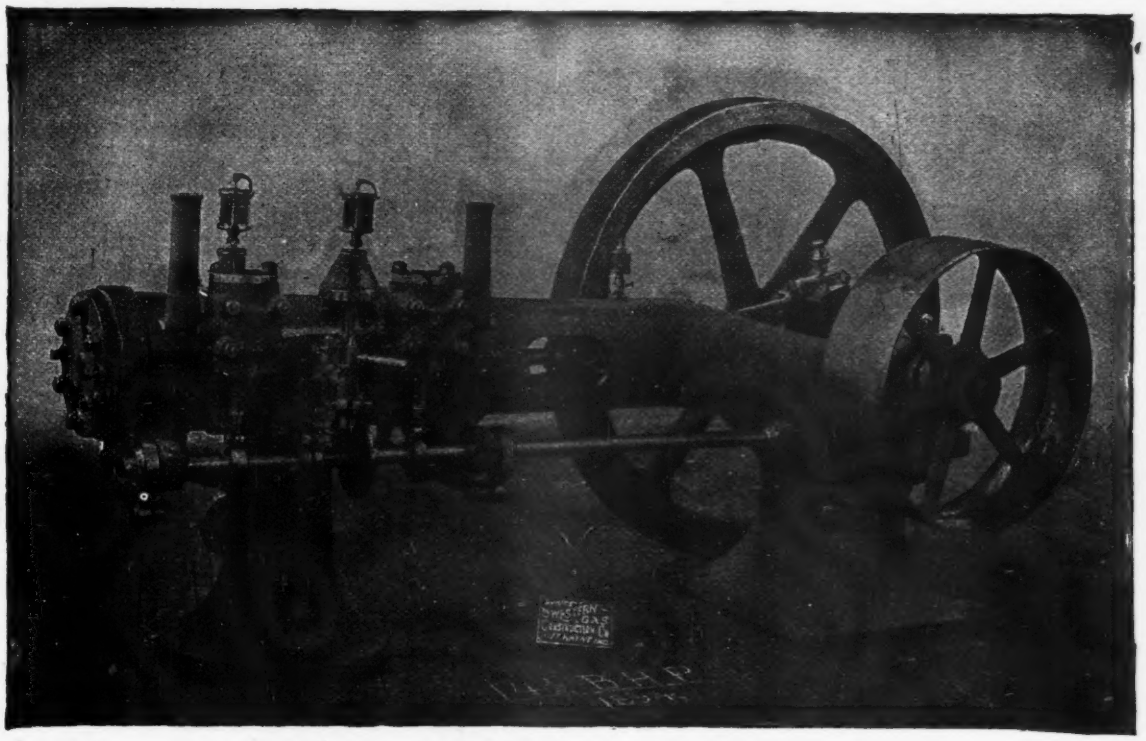

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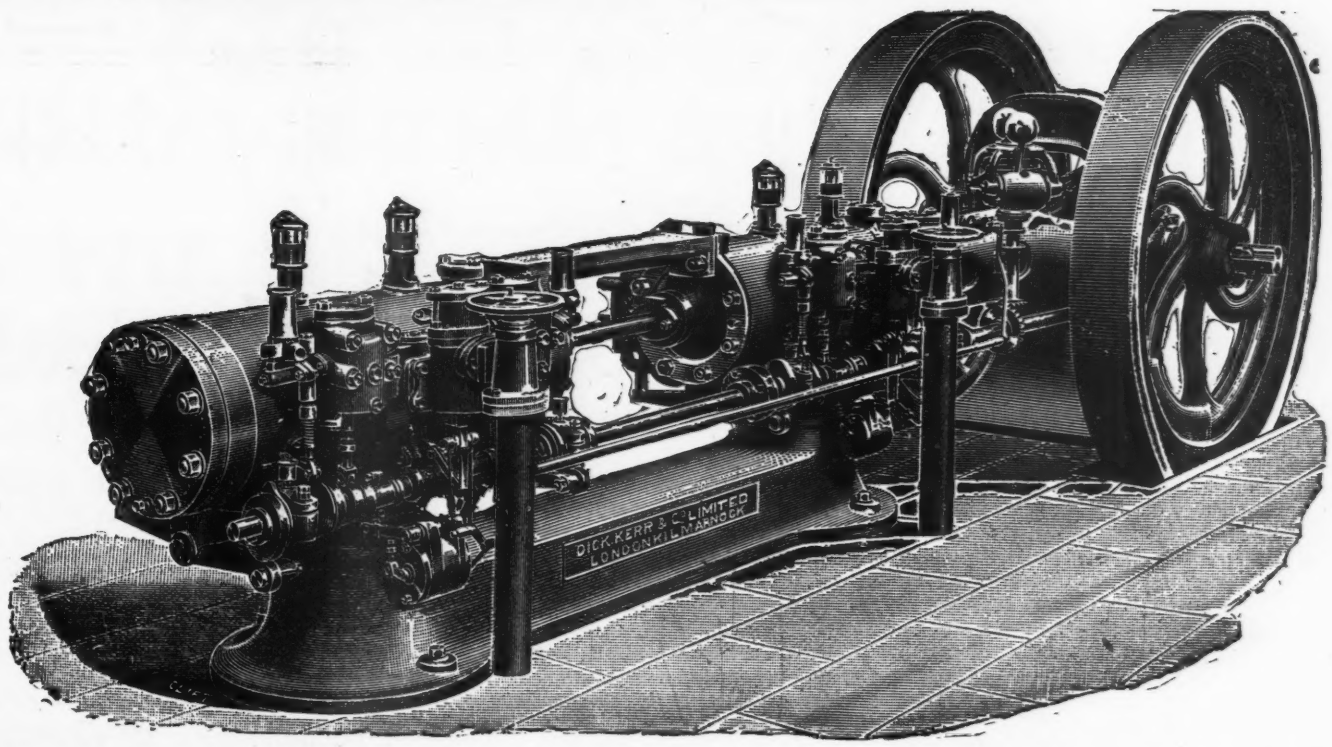

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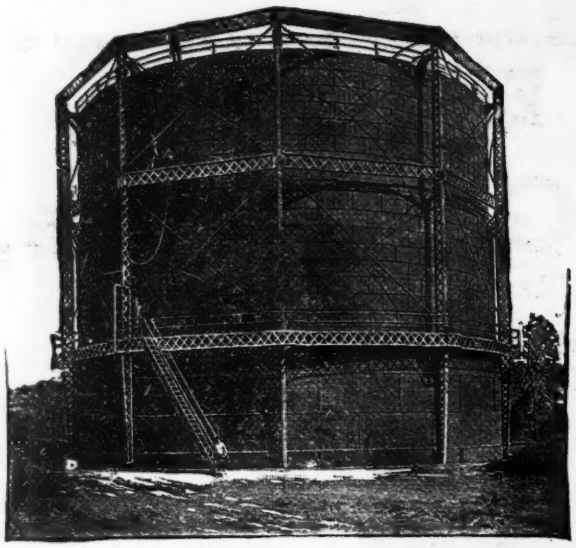

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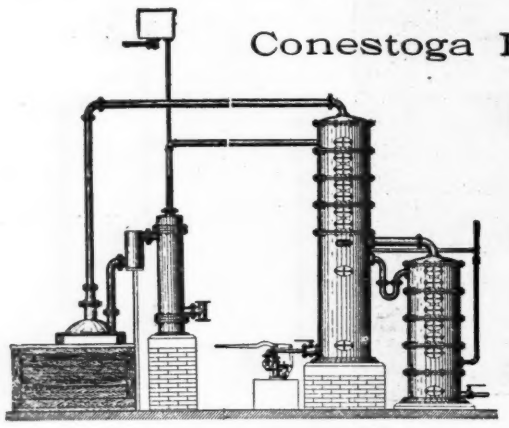

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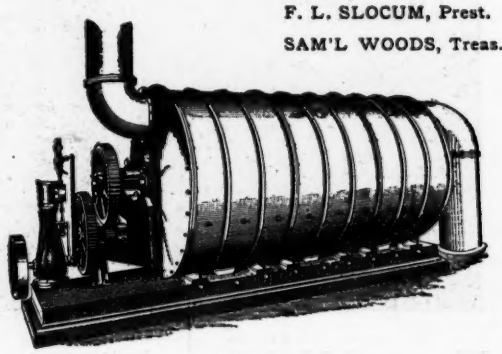

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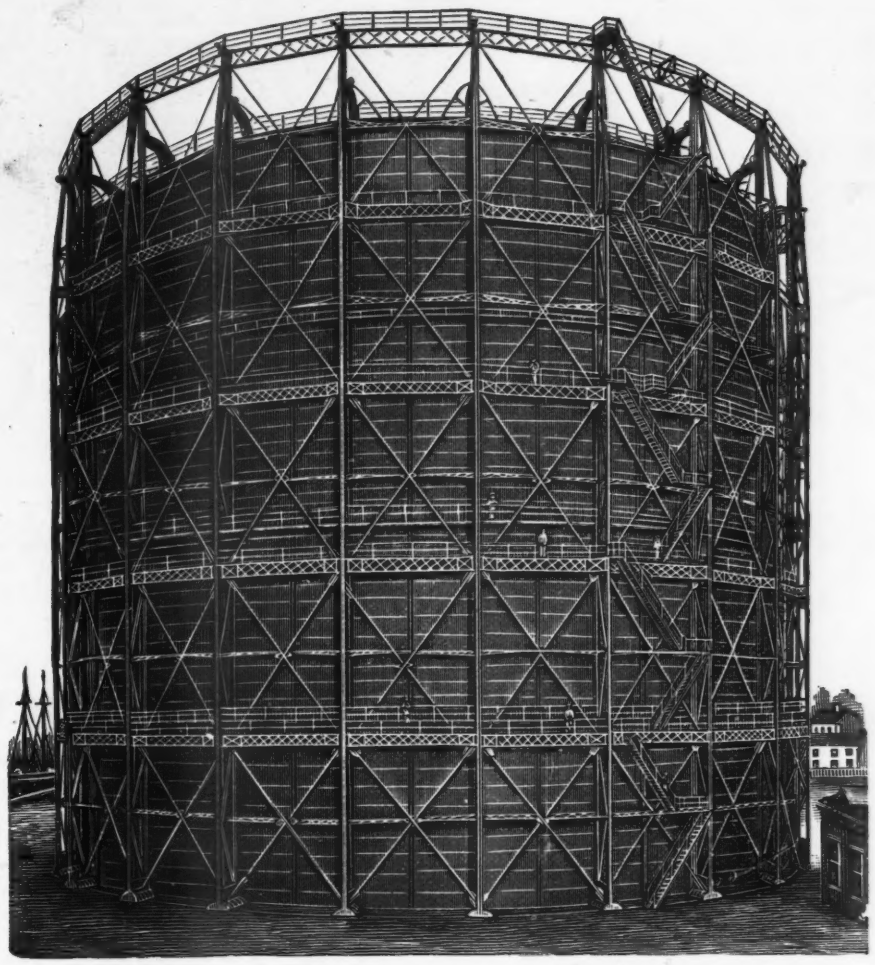

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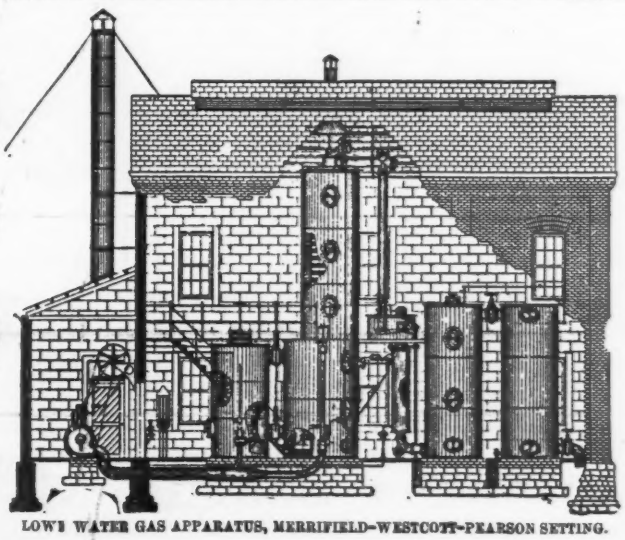

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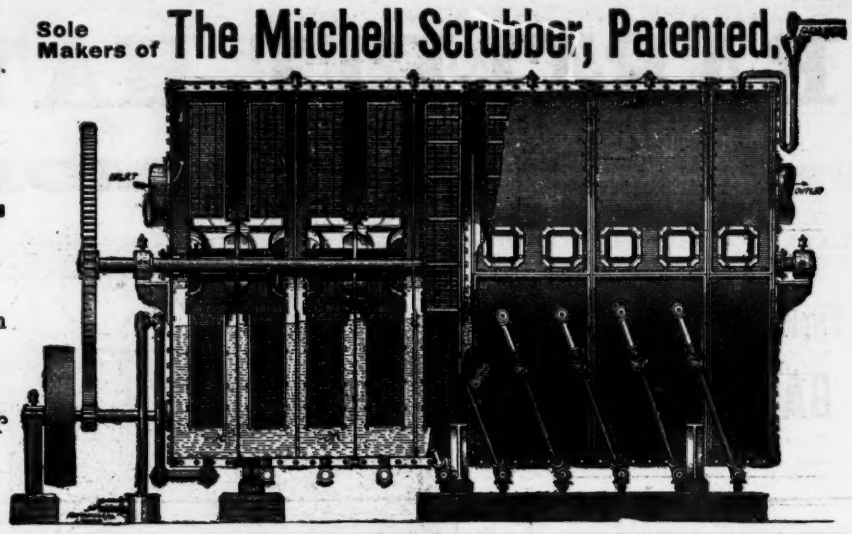

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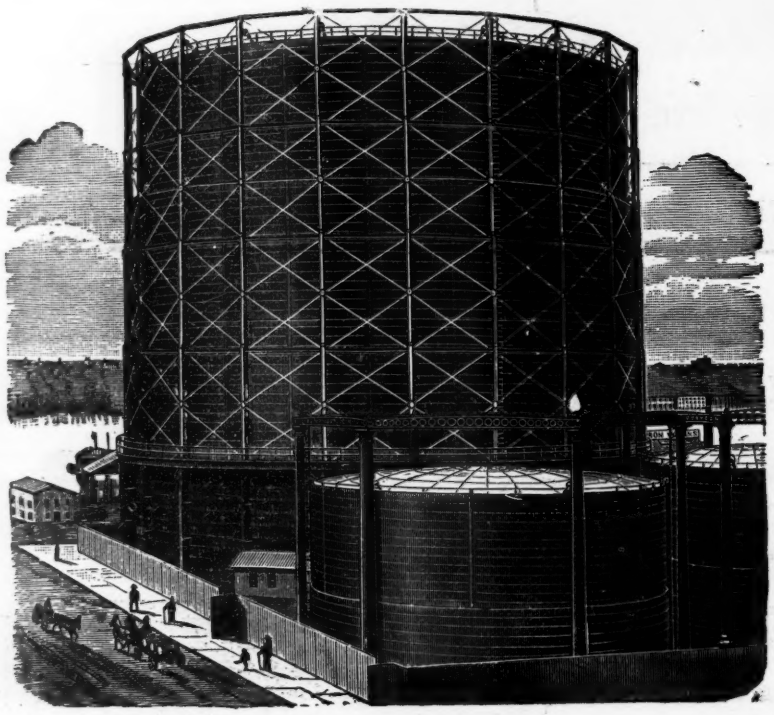

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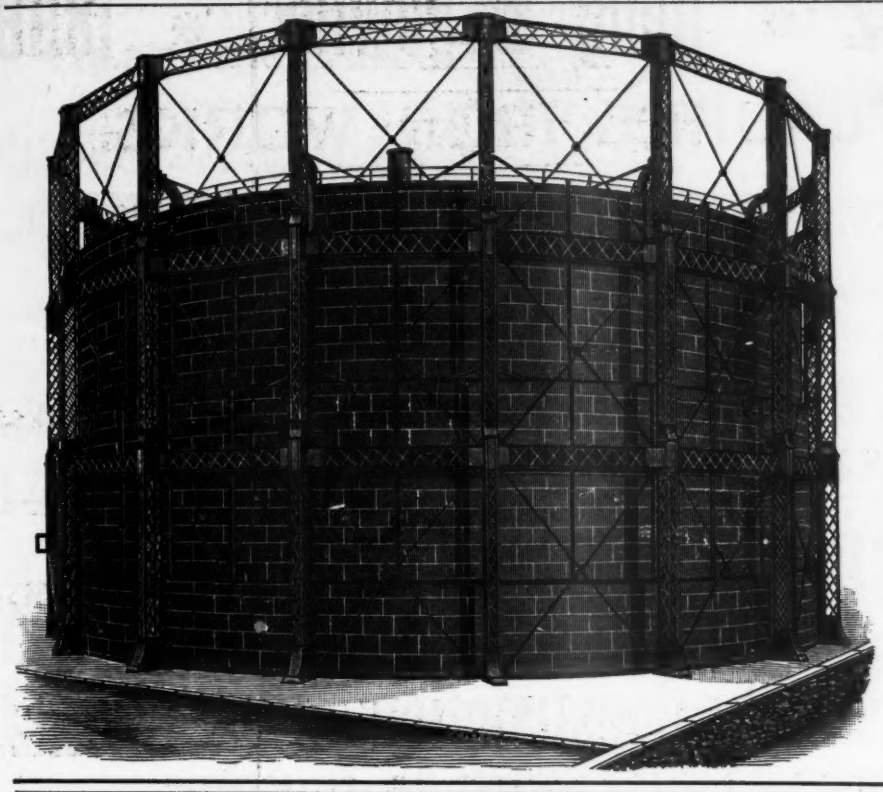

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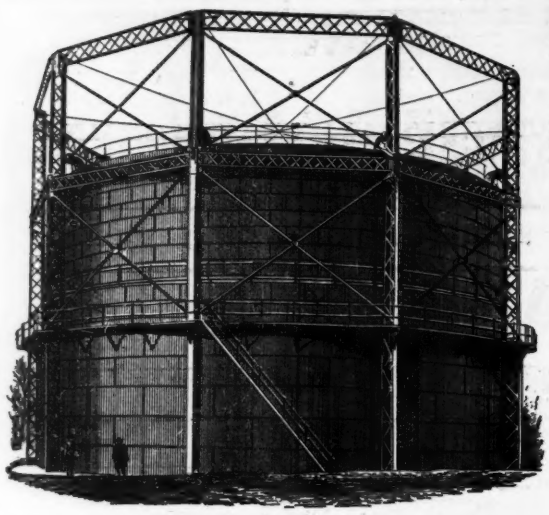

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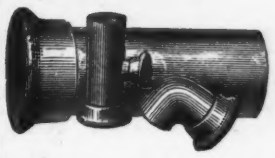

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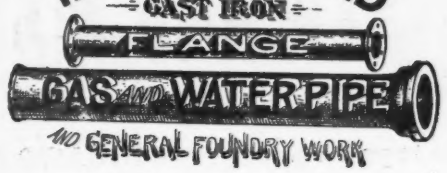

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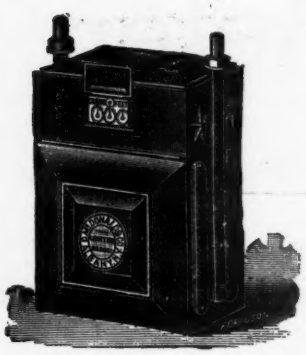

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